Thecus®
Creator in Storage

User's Manual

N2310 series

v1.0

❖ Copyright and Trademark Notice

Thecus and other names of Thecus products are registered trademarks of Thecus Technology Corp. Microsoft, Windows, and the Windows logo are registered trademarks of Microsoft Corporation. Apple, iTunes and Apple OS X are registered trademarks of Apple Computers, Inc. All other trademarks and brand names are the property of their respective owners. Specifications are subject to change without notice.

Copyright © 2013 Thecus Technology Corporation. All rights reserved.

❖ About This Manual

All information in this manual has been carefully verified to ensure its correctness. In case of an error, please provide us with your feedback. Thecus Technology Corporation reserves the right to modify the contents of this manual without notice.

Product name: Thecus N2310 Series

Manual Version: 1.0

Release Date: September, 2013

❖ Limited Warranty

Thecus Technology Corporation guarantees all components of Thecus NAS products are thoroughly tested before they leave the factory and should function normally under general usage. In case of any system malfunctions, Thecus Technology Corporation and its local representatives and dealers are responsible for repair without cost to the customer if the product fails within the warranty period and under normal usage. Thecus Technology Corporation is not responsible for any damage or loss of data deemed to be caused by its products. It is highly recommended that users conduct necessary back-up practices.

Check the functions that are available on your particular Thecus NAS model at:

http://www.thecus.com.

❖ Safety Warnings

For your safety, please read and follow the following safety warnings:

- Read this manual thoroughly before attempting to set up your Thecus IP storage.
- Your Thecus IP storage is a complicated electronic device. DO NOT attempt to repair it under any circ umstances. In the case of malfunction, turn off the power immediately and have it repaired at a qualified service center. Contact your vendor for details.
- DO NOT allow anything to rest on the power cord and DO NOT place the power cord in an area where it can be stepped on. Carefully place connecting cables to avoid stepping or tripping on them.
- Your Thecus IP storage can operate normally under temperatures between 5°C and 40°C, with relative humidity of 20% – 85%. Using Thecus IP storage under extreme environmental conditions could damage the unit.
- Ensure that the Thecus IP storage is provided with the correct supply voltage (AC 100V ~ 240V, 50/60 Hz, 3A). Plugging the Thecus IP storage to an incorrect power source could damage the unit.
- Do NOT expose Thecus IP storage to dampness, dust, or corrosive liquids.
- Do NOT place Thecus IP storage on any uneven surfaces.
- DO NOT place Thecus IP storage in direct sunlight or expose it to other heat sources.
- DO NOT use chemicals or aerosols to clean Thecus IP storage. Unplug the power cord and all connected cables before cleaning.
- DO NOT place any objects on the Thecus IP storage or obstruct its ventilation slots to avoid overheating the unit.
- Keep packaging out of the reach of children.
- If disposing of the device, please follow your local regulations for the safe disposal of electronic products to protect the environment.

❖ Table of Contents

Copyright and Trademark Notice..... ii

About This Manual..... ii

Limited Warranty. ii

Safety Warnings. iii

§Chapter 1: Introduction..... 1

1.1 Overview..... 1

1.2 Package Contents. 1

1.3 Front Panel 2

1.4 Rear Panel..... 3

§Chapter 2: Hardware Installation. 4

§Chapter 3: System Administration. 6

3.1 Overview..... 6

3.2 Web Administration Interface. 6

3.2.1 My Favorite. 7

3.2.2 Control Panel..... 7

3.2.3 Message Bar..... 8

3.2.4 Logout..... 8

3.2.5 Online Update Notification. 8

3.2.6 Language Selection. 9

3.3 System Management. 9

3.3.1 General. 9

3.3.2 System/Service Status..... 10

3.3.3 Logs. 10

3.3.4 Syslog Management..... 11

3.3.5 Time: Setting system time 12

3.3.6 Notification configuration. 12

3.3.7 Schedule Power On/Off..... 13

3.3.8 Administrator Password. 14

3.3.9 Config Mgmt. 14

3.3.10 Factory Default..... 14

3.3.11 Power Management. 15

3.3.12 File System Check. 15

3.3.13 UI Login Function. 17
3.3.14 Networking. 17
3.4 Storage Management. 18
3.4.1 Disks Information. 18
3.4.2 RAID Information. 20
3.5 File Sharing/Privilege. 27
3.5.1 Local User Configuration. 27
3.5.2 Local Group Configuration. 29
3.5.3 Batch Users and Groups Creation. 30
3.5.4 Share Folder. 31
3.5.5 User Quota. 35
3.5.6 User and Group Backup. 36
3.6 Network Service. 37
3.6.1 Samba / CIFS. 37
3.6.2 AFP (Apple Network Setup). 39
3.6.3 FTP 39
3.6.4 WebService 40
3.6.5 UPnP. 41
3.6.6 Bonjour Setting. 41
3.6.7 SSH. 41
3.6.8 DDNS. 42
3.6.9 UPnP Port Management. 42
3.7 Application Server. 44
3.7.1 iTunes® Server (Built in). 44
3.7.2 Add-on Official Applications. 44
3.7.3 Module Installation. 44
3.7.4 NAS Application. 45
3.8 Backup. 45
3.8.1 Rsync Target Server. 45
3.8.2 Data Guard (Remote Backup). 46
3.8.3 Data Guard (Local Backup). 56
3.8.4 ACL Backup and Restore. 67
3.8.5 Data Burn. 68
3.9 External Devices. 71
3.9.1 Printers. 71

3.9.2 Uninterrupted Power Source. 76
Appendix A: Customer Support. 77
Appendix B: RAID Basics. 78
Appendix C: Licensing Information. 81

§Chapter 1: Introduction

1.1 Overview

Thank you for choosing the Thecus IP Storage Server. The Thecus IP storage is an easy-to-use storage server that allows a dedicated approach to storing and distributing data on a network. Gigabit Ethernet ports enhance network efficiency, allowing Thecus IP storage to take over file management functions, increase application and data sharing and provide faster data response. The Thecus IP storage offers data mobility with a disk roaming feature that lets you swap working hard drives for use in other Thecus IP storage, securing the continuity of data in the event of hardware failure. The Thecus IP storage allows data consolidation and sharing between Windows (SMB/CIFS) and Apple OS X environments. The Thecus IP storage's user-friendly GUI supports multiple Languages.

1.2 Package Contents

- **N2310**

The Thecus IP storage should contain the following common items:

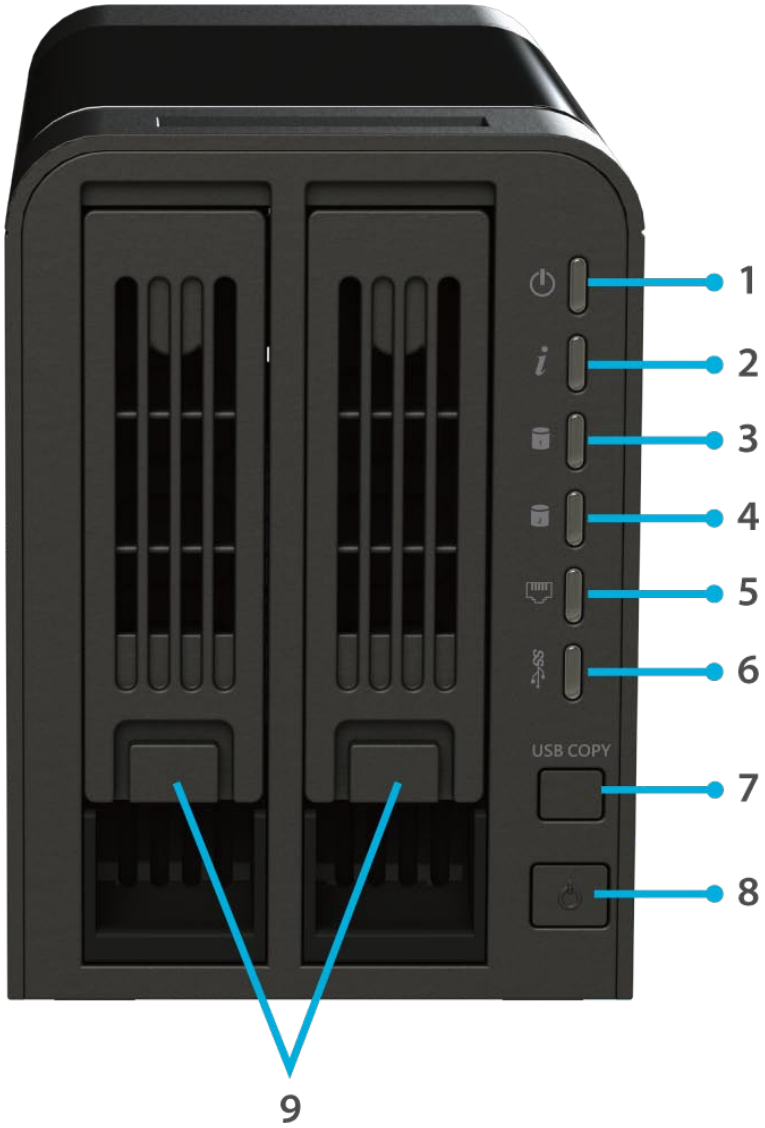
- System Unit x1
- QIG (Quick Installation Guide) x1
- CD-Title (Universal CD) x1
- Ethernet Cable x1
- Accessory bag x1
- Multiple Language Warranty Card x1
- Power adapter x1
- Power cord x1

Please check to see if your package is complete. If you find that some items are missing, contact your dealer.

1.3 Front Panel

- **N2310:**

The Thecus N2310's front panel shows the device's indicators and hard disk install slots:

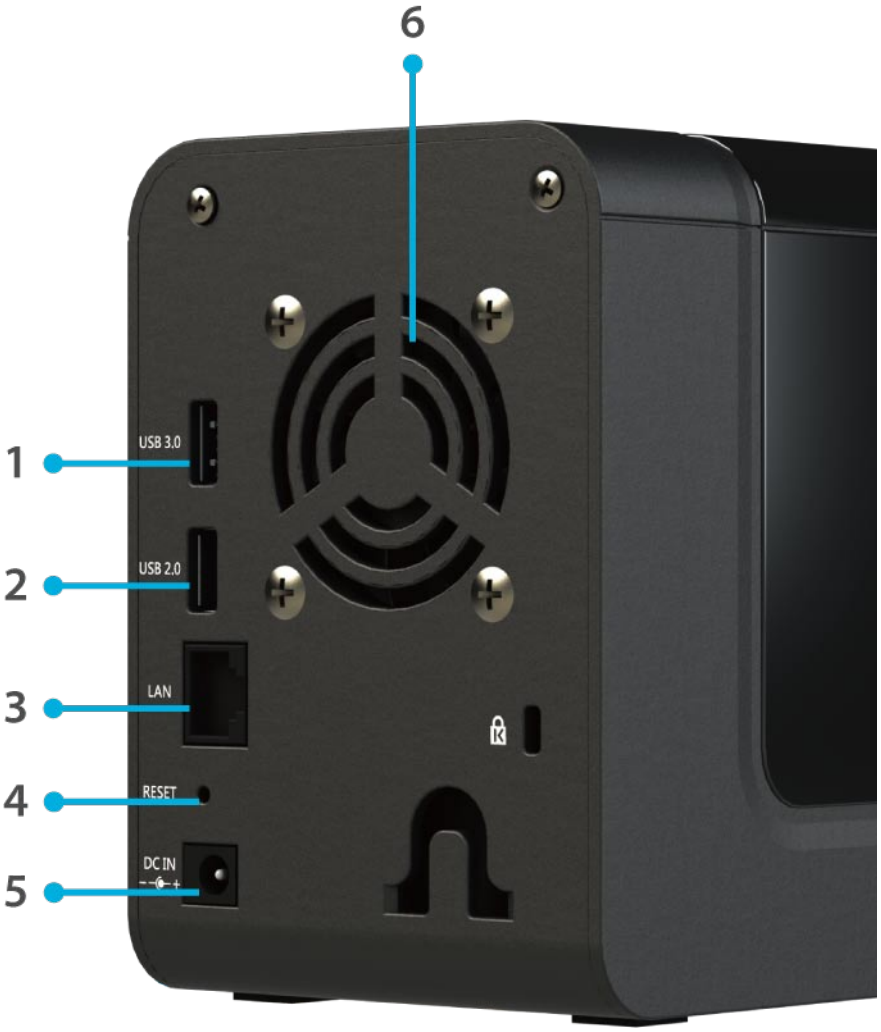


Front Panel	
Item	**Description**
1. Power LED	Solid blue: System ready Blinking blue: Power on process Solid Red: System with error occurred
2. System status LED	Blinking white: Diagnostic mode kick-in Solid white: Diagnostic completed Solid Red: System with error occurred
3. HDD1 LED	Blinking white: HDD activity Red: HDD failure
4. HDD2 LED	Blinking white: HDD activity Red: HDD failure
5. LAN LED	Solid white: LAN Cable link Blinking : Network activity
6. USB LED	Solid white: Installed Blinking white: USB copy activity Solid Red: USB copy failure
7. USB Copy Button	Copies USB storage contents to N2310.
8. Power Button	Power the N2310 on/off.
9. HDD Trays	Two HDD Trays for two 2.5"/3.5" SATA HDDs with Hot-swappable supports.

1.4 Rear Panel

- **N2310:**

The N2310 rear panel features ports and connectors.



Back Panel	
Item	**Description**
1. USB 3.0 Port	USB 3.0 port for compatible USB devices, such as digital cameras, USB disks, and USB printers.
2. USB 2.0 Port	USB 2.0 port for compatible USB devices, such as digital cameras, USB disks, and USB printers.
2. LAN Port	LAN port for connecting to an Ethernet network through a switch or a router.
4. Reset Button	Resets the N2310. Pressing and holding the Reset button on the back for 5 seconds will reset your network setting and password, and turn off Jumbo Frame Support.
5. Power Connector	Connect the included power cords to this connector.
6. System Fan	System fan that exhausts heat from the unit.

§Chapter 2: Hardware Installation

2.1 Overview

Your Thecus IP storage is designed for easy installation. To help you get started, the following chapter will help you quickly get your Thecus IP storage up and running. Please read it carefully to prevent damaging your unit during installation.

2.2 Before You Begin

Before you begin, be sure to take the following precautions:

1. Read and understand the Safety Warnings outlined in the beginning of the manual.
2. If possible, wear an anti-static wrist strap during installation to prevent static discharge from damaging the sensitive electronic components on the Thecus IP storage.
3. Be careful not to use magnetized screwdrivers around the Thecus IP storage's electronic components.

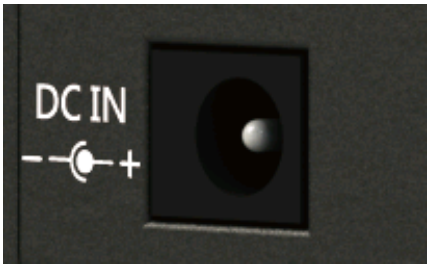
2.3 Cable Connections

To connect the Thecus IP storage product to your network, follow the steps below:

1. Connect an Ethernet cable from your network to the LAN port on the back panel of the Thecus IP storage.

▲ N2310 LAN port

2. Connect the provided power cord into the universal power socket on the back panel. Plug the other end of the cord into a surge protector socket.



▲ N2310 power socket

3. Press the power button on the Front Panel to boot up the Thecus IP storage.

▲ N2310 power button

§Chapter 3: System Administration

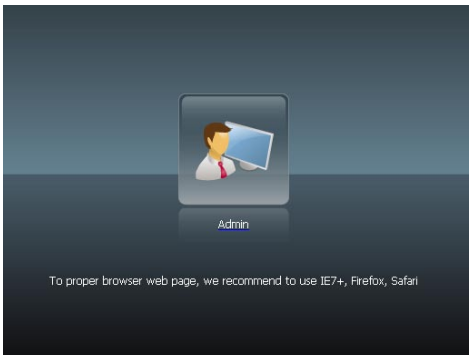
3.1 Overview

The Thecus IP storage provides an easily accessible Web Administration Interface. With it, you can configure and monitor the Thecus IP storage anywhere on the network.

3.2 Web Administration Interface

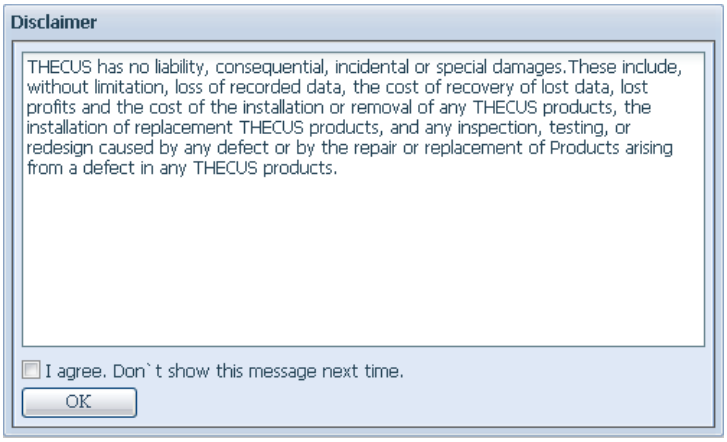
Make sure your network is connected to the Internet. To access Thecus IP storage Web Administration Interface:

1. Type the Thecus IP storage IP address into your browser. (Default IP address can be found through IntelligentNAS utility)



2. Login to the system using the administrator user name and password. The factory defaults are:
   User Name: admin
   Password: admin

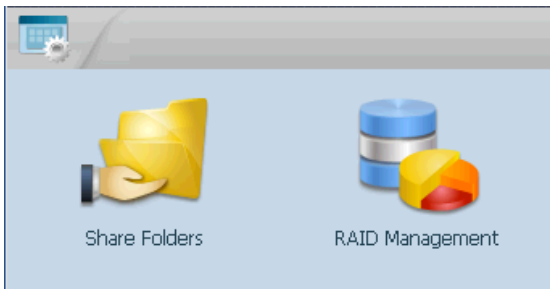
   Once you are logged in as an administrator, the disclaimer page will appear as below. Please click the check box if you do not want to have this page displayed during the next login.


Disclaimer
THECUS has no liability, consequential, incidental or special damages.These include, without limitation, loss of recorded data, the cost of recovery of lost data, lost profits and the cost of the installation or removal of any THECUS products, the installation of replacement THECUS products, and any inspection, testing, or redesign caused by any defect or by the repair or replacement of Products arising from a defect in any THECUS products.
I agree. Don`t show this message next time.
OK

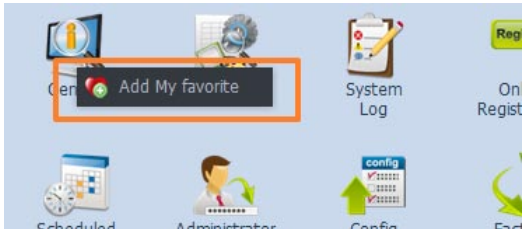
   Following the disclaimer page, you will see the Web Administration Interface. From here, you can configure and monitor virtually every aspect of the Thecus IP storage from anywhere on the network.

3.2.1 My Favorite

The user interface with "My Favorite" shortcut allows the user to designate often used items and have them display on the main screen area. The figure below displays system favorite functions.



Administrators can add or remove favorite functions to My Favorites by right clicking the mouse on the menu tree.



3.2.2 Control Panel

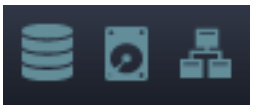
The Control Panel is where you will find all of the information screens and system settings of Thecus IP storage.

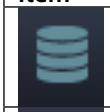
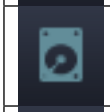
Control Panel	
Item	**Description**
System Management	Current system status of the Thecus IP storage.
Storage	Information and settings for storage devices installed into the Thecus IP storage.
File Sharing / Privilege	Allows configuration of users and groups.
Network Service	To setup varies protocols which has supported by system
Application Server	Application based program for system build-in, additional installed from official or 3rd party.
Backup	Category of Backup Features setup of the Thecus IP storage.
External Devices	Setting for devices where has installed through external interface such as USB

In the following sections, you will find detailed explanations of each function, and how to configure your Thecus IP storage.

3.2.3 Message Bar

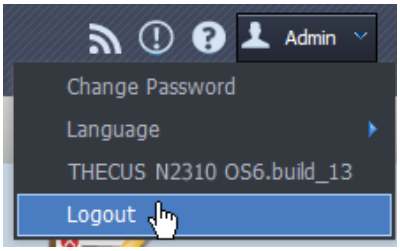
You can get quick information about your system status by moving your mouse over these icons.



Message Bar		
Item	**Status**	**Description**
	RAID Information.	Display the status of created RAID volume. Click to go to RAID information page as short cut.
	Disks Information.	Display the status of disks installed in the system. Click to go to Disk information page as short cut.
	Network.	Green: Connection to the network is normal. Red: abnormal connection to the network

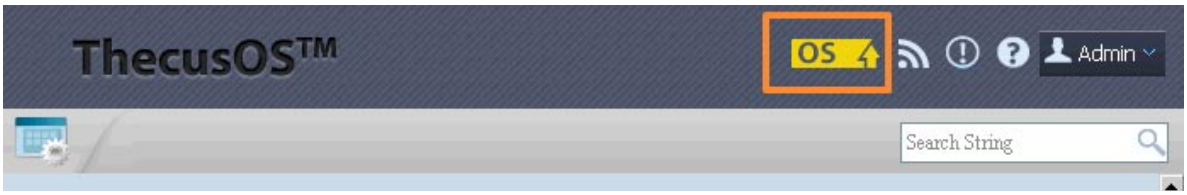
3.2.4 Logout

Click to logout Web Administration Interface.



3.2.5 Online Update Notification

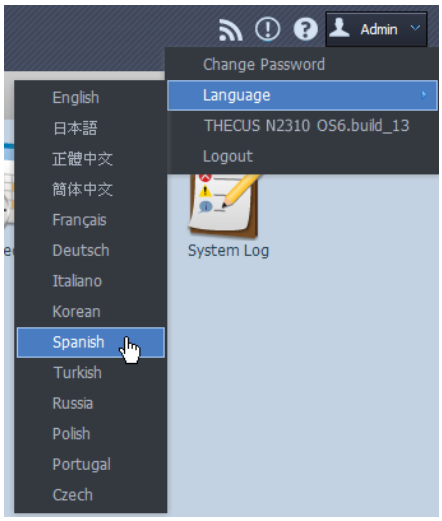
When there is a new update for system files or applications, the system will notify you through the admin UI and also send an email. Click on the flashing icon then the system will link you directly to the associated page.



3.2.6 Language Selection

The Thecus IP storage supports multiple Languages, including:

- English
- Japanese
- Traditional Chinese
- Simplified Chinese
- French
- German
- Italian
- Korean
- Spanish
- Russian
- Polish
- Portuguese



On the menu bar, click Language and the selection list appears. This user interface will switch to the selected language for Thecus IP storage.

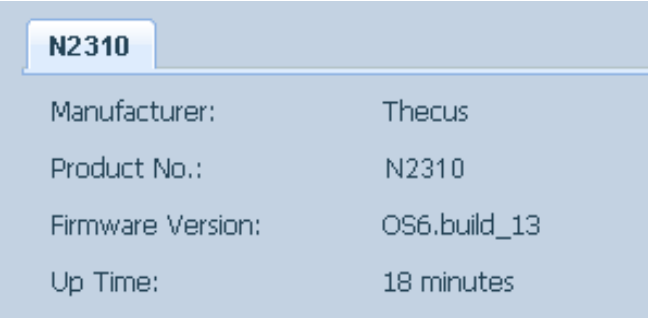
3.3 System Management

Information provides viewing on current Product info, System Status, Service Status and Logs.

The menu bar allows you to see various aspects of the Thecus IP storage. From here, you can discover the status of the Thecus IP storage, and also other details.

3.3.1 General

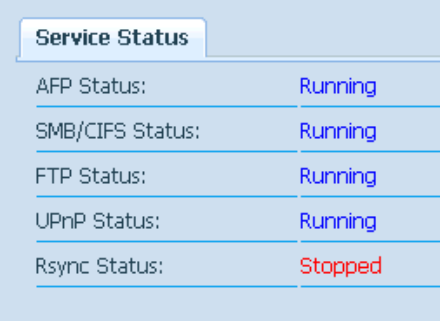
Once you login, you will first see the basic system Information screen providing Manufacturer, Product No., Firmware Version, and System Up Time information.



General	
Item	**Description**
Manufacturer	Displays the name of the system manufacturer.
Product No.	Shows the model number of the system.
Firmware version	Shows the current firmware version.
Up time	Displays the total run time of the system.

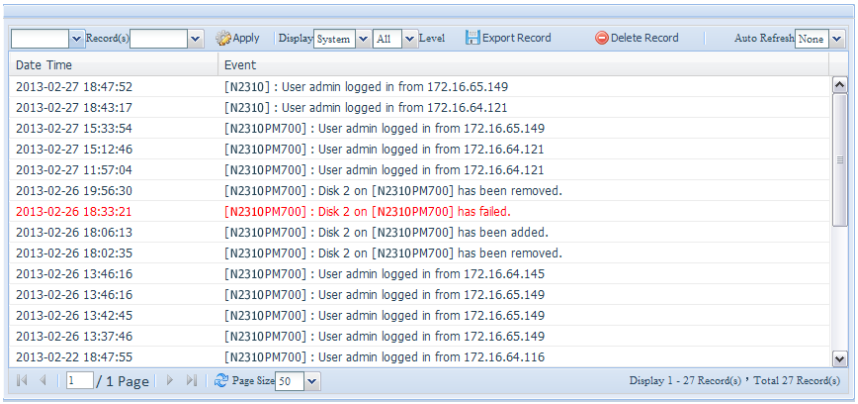
3.3.2 System/Service Status

From the System Management category,, choose the Status item, System Service Status and HW Status screens appear. These screens provide basic system and service status information.



3.3.3 Logs

From the System Management category, choose the System Logs item and the System Logs screen appears. This screen shows a history of system usage and important events such as disk status, network information, and system booting. See the following table for a detailed description of each item:


Record(s)
Apply
Display System All Level
Export Record
Delete Record
Auto Refresh None
Date Time
Event
2013-02-27 18:47:52 [N2310] : User admin logged in from 172.16.65.149
2013-02-27 18:43:17 [N2310] : User admin logged in from 172.16.64.121
2013-02-27 15:33:54 [N2310PM700] : User admin logged in from 172.16.65.149
2013-02-27 15:12:46 [N2310PM700] : User admin logged in from 172.16.64.121
2013-02-27 11:57:04 [N2310PM700] : User admin logged in from 172.16.64.121
2013-02-26 19:56:30 [N2310PM700] : Disk 2 on [N2310PM700] has been removed.
2013-02-26 18:33:21 [N2310PM700] : Disk 2 on [N2310PM700] has failed.
2013-02-26 18:06:13 [N2310PM700] : Disk 2 on [N2310PM700] has been added.
2013-02-26 18:02:35 [N2310PM700] : Disk 2 on [N2310PM700] has been removed.
2013-02-26 13:46:16 [N2310PM700] : User admin logged in from 172.16.64.145
2013-02-26 13:46:16 [N2310PM700] : User admin logged in from 172.16.65.149
2013-02-26 13:42:45 [N2310PM700] : User admin logged in from 172.16.65.149
2013-02-26 13:37:46 [N2310PM700] : User admin logged in from 172.16.65.149
2013-02-22 18:47:55 [N2310PM700] : User admin logged in from 172.16.64.116
1 / 1 Page
Page Size 50
Display 1 - 27 Record(s) , Total 27 Record(s)

See the following table for a detailed description of each item:

System Logs	
Item	**Description**
All	Provides all log information including system messages, warning messages and error messages.
INFO	Records information about system messages.
WARN	Shows only warning messages.
ERROR	Shows only error messages.
Download All Log File	Export all logs to an external file.
Truncate All Log File	Clear all log files.
The number of lines per page	Specify desired number of lines to display per page.
Sort Ascending	Shows logs by date in ascending order.
Sort Descending	Shows logs by date in descending order.
|<< < > >>|	Use the forward (> >>|) and backward (|<< <) buttons to browse the log pages.

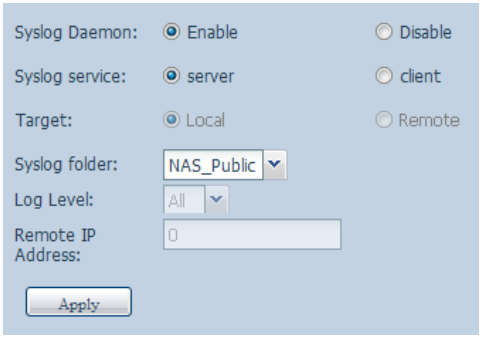
	Re-loading logs.

3.3.4 Syslog Management

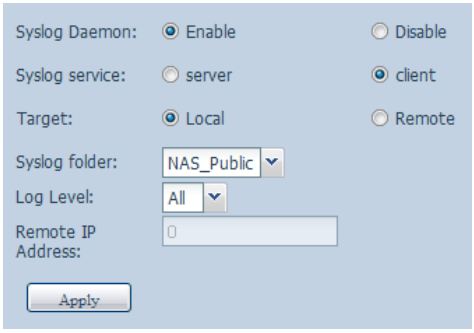
Generates system log to be stored locally or remotely, it also can be chose to act as syslog server for all other devices.

Information can be obtained in two ways: locally and remotely.

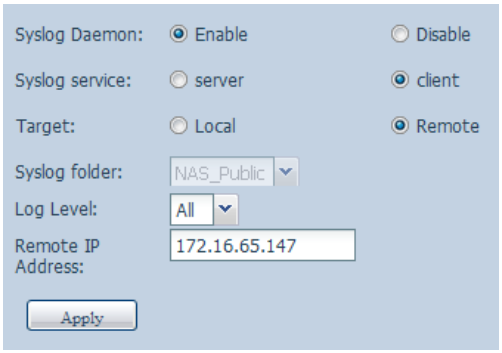
- **Configuration with syslog server:**



- **Configuration with syslog client and target to store locally:**



- **Configuration with syslog client and target to store remotely:**



See the following table for a detailed description of each item:

Syslog Management	
Item	**Description**
Syslog Daemon	Enable/Disable syslog daemon.
Syslog service	If Server has been selected then associated syslog folder will be used to store all system logs from other NAS devices which has assigned this system for syslog server as well as syslog of this server unit. It can be seen from associated syslog folder with files "error", "Information" and "warning". If client has been selected then "Local" or "Remotely" can be choose.
Target	Choose Local, all system logs will be stored in an associated syslog folder filled in from next filed. And the syslog folder will have file "messages" to store all system logs. If Remotely has been selected, a syslog server is needed and an IP address is required.
Syslog folder	Select from a drop down share list, all of the system logs will be stored on it. This syslog folder is applied to "syslog server" or "syslog client" with "local" selected.
Log Level	The user can choose from 3 different levels. "All", "Warning/Error" or "Error".
Remote IP Address	Input the syslog server IP address if choose to store syslog info remotely.

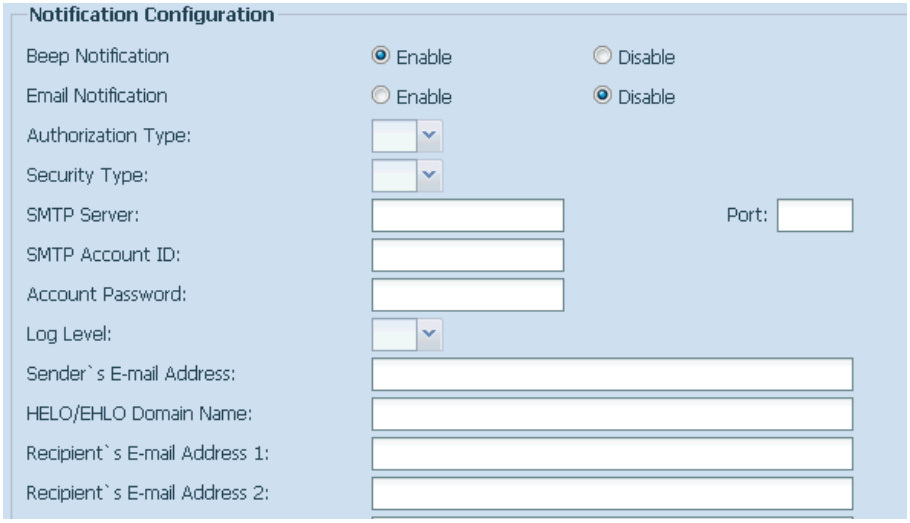
3.3.5 Time: Setting system time

From the System Management category, choose the Time item and the Time screen appears. Set the desired Date, Time, and Time Zone. You can also elect to synchronize the system time on Thecus IP storage with an NTP (Network Time Protocol) Server.

See the following table for a detailed description of each item:

Time	
Item	**Description**
Date	Sets the system date.
Time	Sets the system time.
Time Zone	Sets the system time zone.
NTP Service	Select ***Enable*** to synchronize with the NTP server. Select Disable to close the NTP server synchronization.
Sync with external NTP Server	Select YES to allow Thecus IP storage to synchronize with an NTP server of your choice. Press Apply to change.

3.3.6 Notification configuration



From the System Management category, choose the Notification item, and the Notification Configuration screen appears. This screen lets you have Thecus IP storage notify you in case of any system malfunction. Press Apply to confirm all settings. See following table for a detailed description of each item.

Notification Configuration	
Item	**Description**
Beep Notification	Enable or disable the system buzzer that beeps when a problem occurs.
Email Notification	Enable or disable email notifications of system problems.
Authentication Type	Select the SMTP Server account authentication type.
SMTP Server	Specifies the hostname/IP address of the SMTP server.
Port	Specifies the port to send outgoing notification emails.
SMTP Account ID	Set the SMTP Server Email account ID.
Account Password	Enter a new password.
Log Level	Select the log level to send the e-mail out.

Sender's E-mail Address	Set senders email address to send email notifications.
Receiver's E-mail Address (1,2,3,4)	Add one or more recipient's email addresses to receive email notifications.

3.3.7 Schedule Power On/Off

Using the Thecus IP storage System Management, you can save energy and money by scheduling the Thecus IP storage to turn itself on and off during certain times of the day.

From the System Management category, choose the Schedule Power On/Off item and the Schedule Power On/Off screen appears.

To designate a schedule for the Thecus IP storage to turn on and off, first enable the feature by checking the Enable Schedule Power On/Off checkbox.

Then, simply choose an on and off time for each day of the week.

Finally, click Apply to save your changes.

Example - Monday: On: 8:00; Off: 16:00

System will turn on at 8:00 AM on Monday, and off at 16:00 on Monday. System will turn on for the rest of the week.

If you choose an on time, but do not assign an off time, the system will turn on and remain on until a scheduled off time is reached, or if the unit is shutdown manually.

Example - Monday: On: 8:00

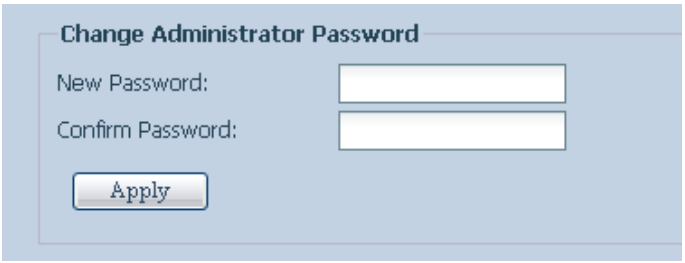
System will turn on at 8:00 AM on Monday, and will not shut down unless powered down manually. You may also choose two on times or two off times on a particular day, and the system will act accordingly.

Example - Monday: Off: 8:00; Off: 16:00

System will turn off at 8:00 AM on Monday. System will turn off at 16:00 PM on Monday, if it was on. If the system was already off at 16:00 PM on Monday, system will stay off.

3.3.8 Administrator Password

From the System Management category, choose the Administrator Password item and the Change Administrator Password screen appears. Enter a new password in the New Password box and confirm your new password in the Confirm Password box. Press Apply to confirm password changes.



See the following table for a detailed description of each item.

Change Administrator	
Item	**Description**
New Password	Type in a new administrator password.
Confirm Password	Type the new password again to confirm.
Apply	Press this to save your changes.

3.3.9 Config Mgmt

From the System Management category, choose the Config Mgmt item and the System Configuration Download/Upload screen appears. From here, you can download or upload stored system configurations.

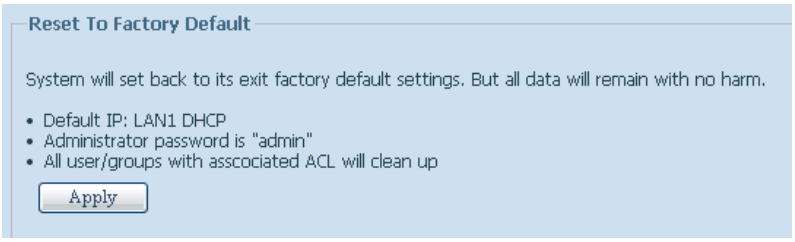
See the following table for a detailed description of each item.

System Configuration Download/Upload	
Item	**Description**
Download	Save and export the current system configuration.
Upload	Import a saved configuration file to overwrite the current system configuration.

Backing up your system configuration is a great way to ensure that you can revert to a working configuration when you are experimenting with new system settings.
The system configuration you have backed up can only be restored in the same firmware version. The backup details exclude user/group accounts.

3.3.10 Factory Default

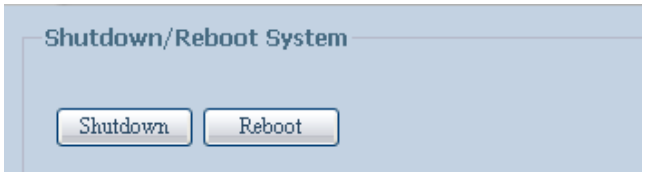
From the System Management category, choose the Factory Default item and the Reset to Factory Default screen appears. Press Apply to reset Thecus IP storage to factory default settings.


Reset To Factory Default
System will set back to its exit factory default settings. But all data will remain with no harm.
Default IP: LAN1 DHCP
Administrator password is "admin"
All user/groups with asscociated ACL will clean up
Apply

Resetting to factory defaults will not erase the data stored in the hard disks, but WILL revert all the settings to the factory default values

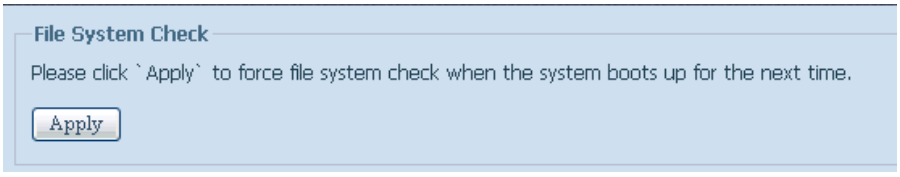
3.3.11 Power Management

From the System Management category, choose Power Management item, and the Shutdown/Reboot System screen appears. Press Reboot to restart the system or Shutdown to turn the system off.



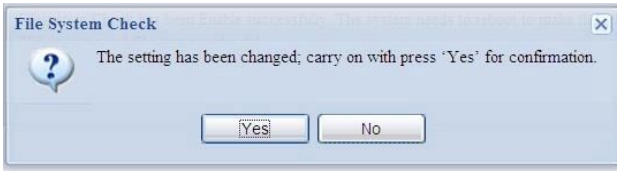
3.3.12 File System Check

The File System Check allows you to perform a check on the integrity of your disks' file system. Under the System Management category, click File system Check and the File System Check prompt appears.

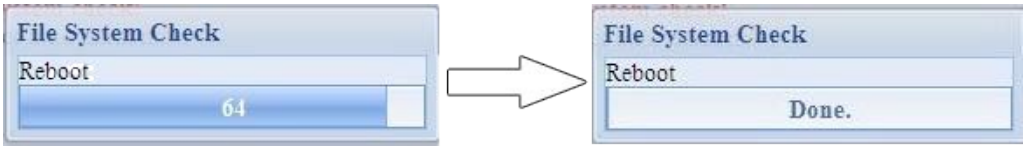


To perform a file system check, click Apply.

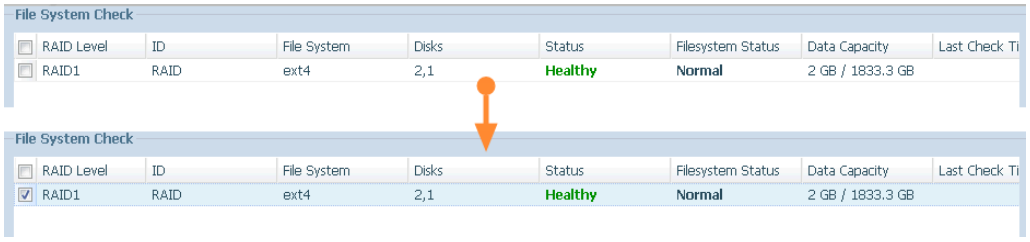
Once clicked, the following prompt will appear:



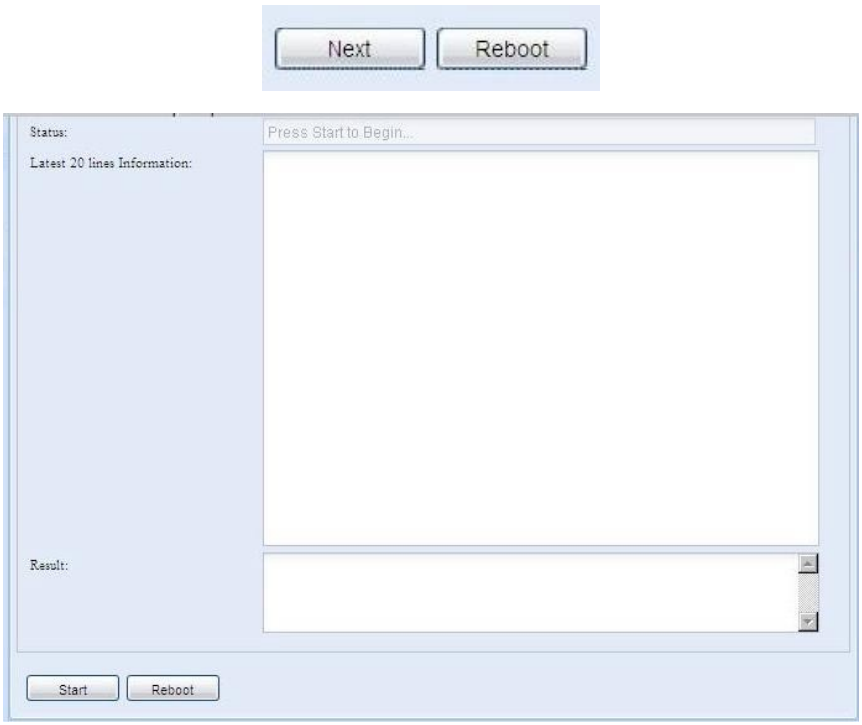
Click Yes to reboot the system.



Once the system has rebooted, you will be returned to the File System Check prompt. There you will see the available RAID volumes to run the file system check. Check the desired RAID volumes and click Next to proceed with the file system check. Click Reboot to reboot without running the check.

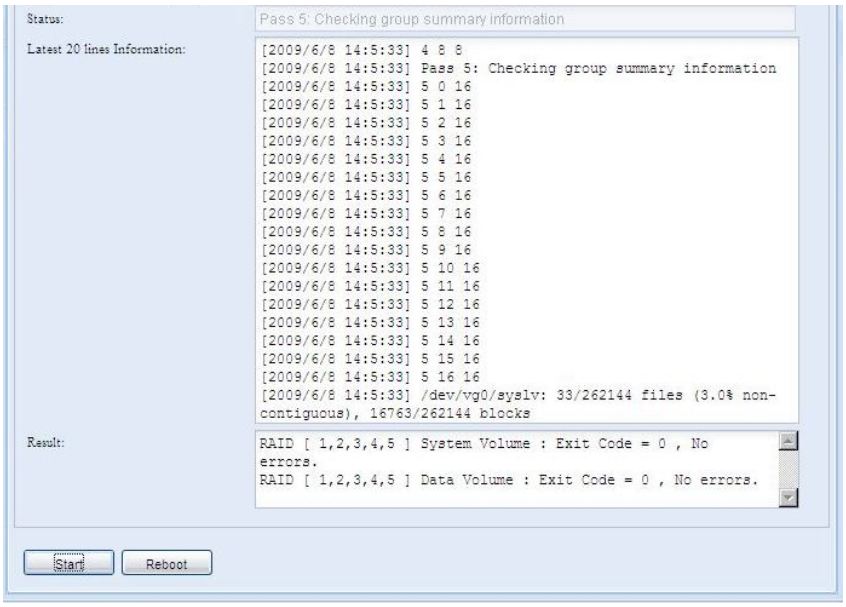


Once you click Next, you will see the following screen:



Click Start to begin the file system check. Click Reboot to reboot the system.

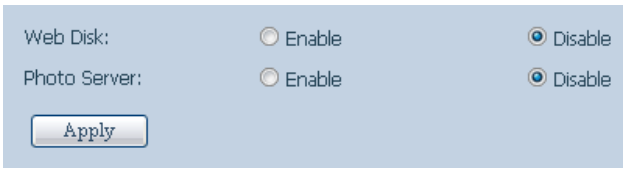
When the file system check is running, the system will show 20 lines of information until it is complete. Once complete, the results will be shown at the bottom.



The system must be rebooted before Thecus IP storage can function normally after file system check completes.

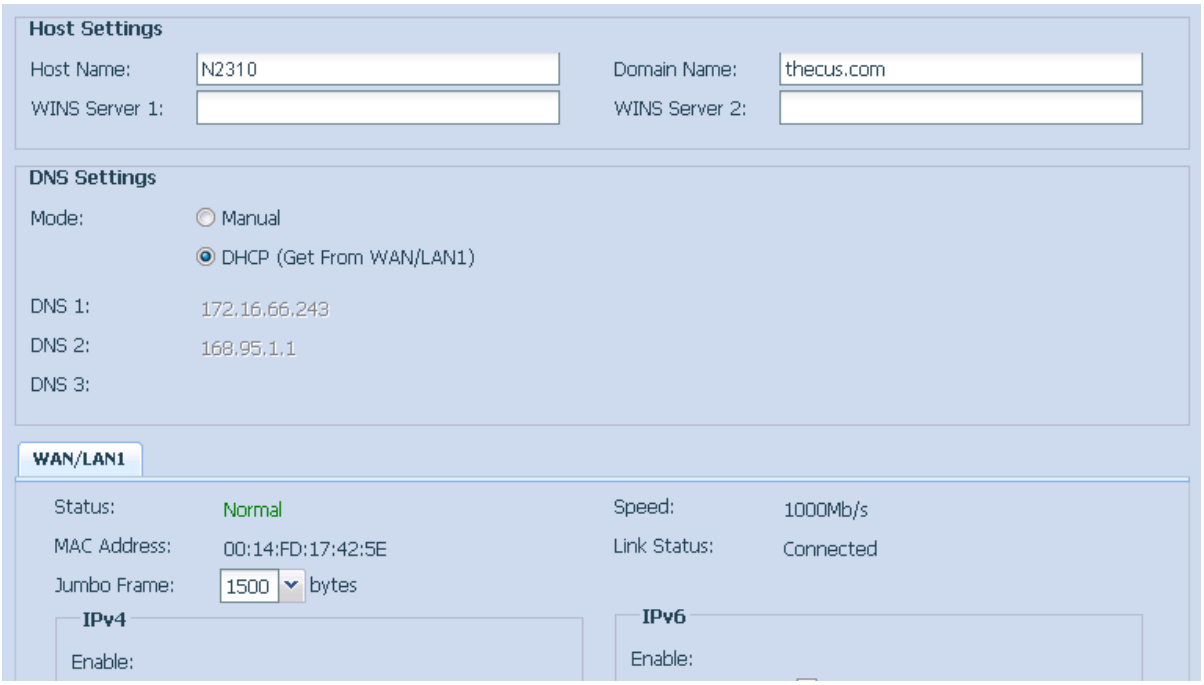
3.3.13 UI Login Function

Adjusts UI Login Configuration settings, you can enable/disable the Web Disk, Photo Server and modules functions, according to your needs.



3.3.14 Networking

From the System Management category, choose Networking, and the Networking Configuration screen appears. This screen displays the network parameters of the global setting and available network connection. You may change any of these items and press Apply to confirm your settings. See a description of each item in the following table:



Network Configuration (Global parameter)	
Item	**Description**
Host name	Host name that identifies the Thecus IP storage on the network.
Domain name	Specifies the domain name of Thecus IP storage.
WINS Server	To set a server name for NetBIOS computer.
DNS Mode	Select the DNS server is coming from DHCP server or manual input. A total of 3 DNS servers can be input. If the DNS setting is chosen from DHCP server, then it will refer to WAN/LAN1 port.
DNS Server 1,2,3	Domain Name Service (DNS) server IP address.
Network Configuration (NIC port)	
Link speed	Display associated NIC port link speed.
Link status	Display associated NIC port link status.
MAC address	MAC address of the network interface.
Jumbo Frame Support	Enable or disable Jumbo Frame Support of associate interface on your Thecus IP storage.
IPv4/IPv6	Click to enable IPv4/IPv6 for TCP/IP. The default is IPv4 enabled.
Mode	It can choose a static IP or Dynamic IP.
IP	IP address of associate NIC interface.
Netmask/Prefix Length	Input netmask for IPv4 and Prefix length for IPv6.

Gateway	Gateway for associate NIC.
Default gateway	It can be chosen from a drop down list of default gateway that's been used for the Thecus IP storage.

- Only use Jumbo Frame settings when operating in a Gigabit environment where all other clients have Jumbo Frame Setting enabled.
- Proper DNS setting is vital to networks services, such as SMTP and NTP.

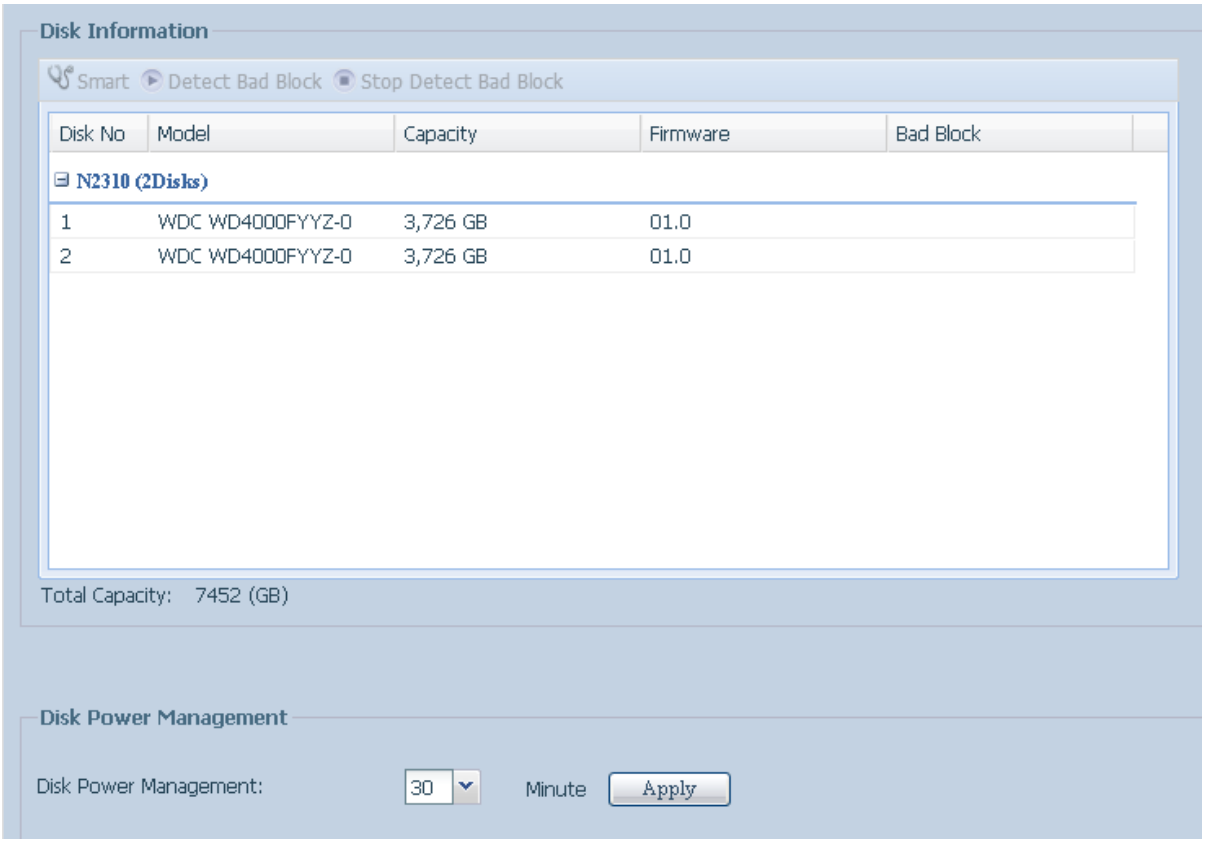
Most faster Ethernet (10/100) Switches/Routers do not support Jumbo Frame and will not be able to connect to your Thecus NAS after Jumbo Frame is turned on.

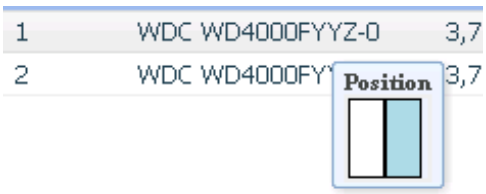
3.4 Storage Management

The Storage menu displays the status of storage devices installed in the Thecus IP storage. It includes storage configuration options such as RAID and disk settings.

3.4.1 Disks Information

From the Storage menu, choose the Disk Information item and the Disk Information screen appears. From here, you can see various installed hard disks. The disk slot position will appear if the mouse is moved over the installed disk.

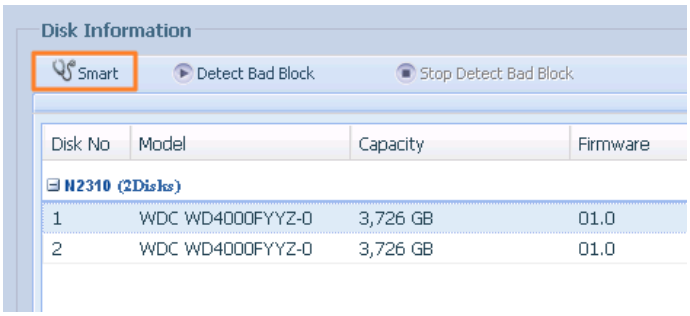




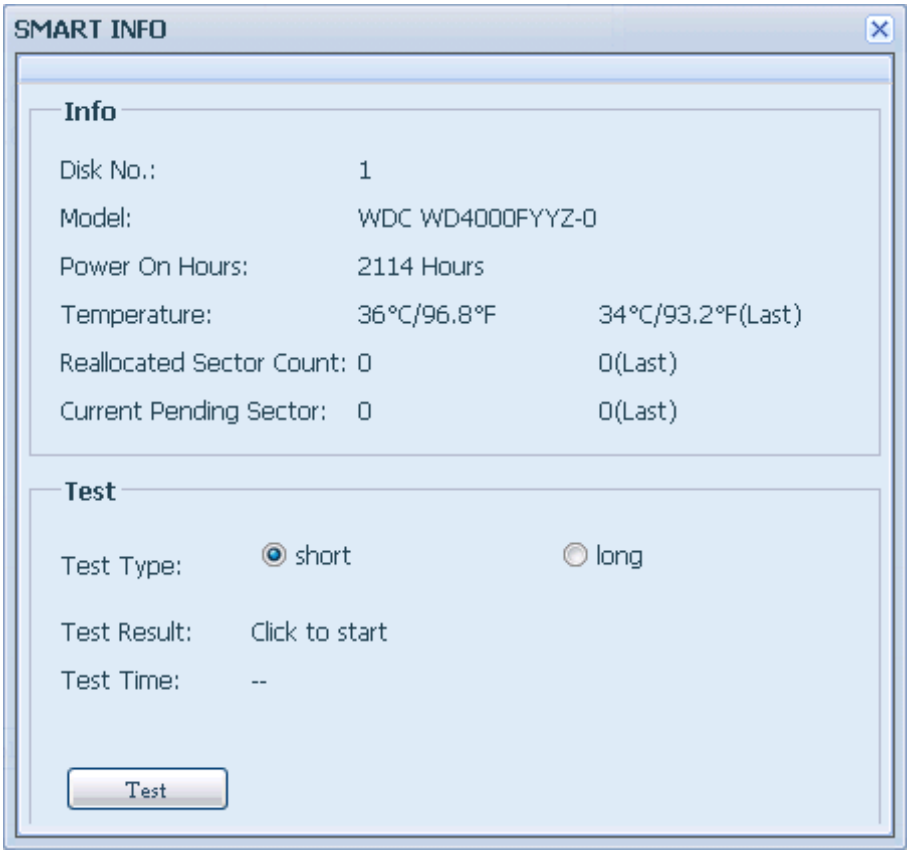
Disks Information	
Item	**Description**
Disk No.	Indicates disk location.
Capacity	Shows the SATA hard disk capacity.
Model	Displays the SATA hard disk model name.
Firmware	Shows the SATA hard disk firmware version.
Bad Block scan	Yes to start scan Bad Block.

- **S.M.A.R.T. Information**

On the Disk Information screen, select a disk then click on "Smart" to list the S.M.A.R.T. info of the associated disk.



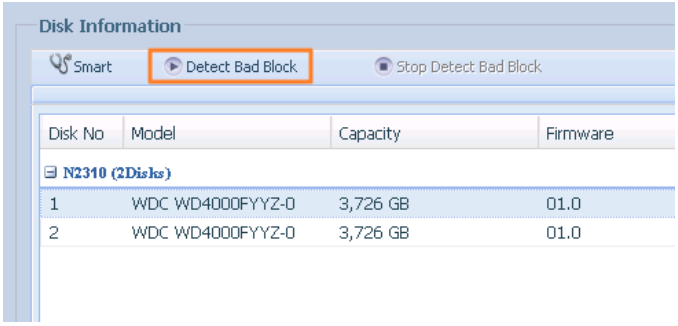
You may also perform a disk SMART test; simply click "Test" to start the SMART test. The result is only for reference and the system will not take any action from its results.



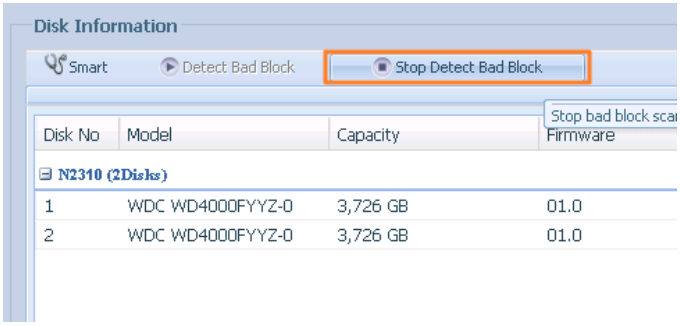
S.M.A.R.T. Information	
Item	**Description**
Tray Number	Tray the hard disk is installed in.
Model	Model name of the installed hard disk.
Power ON Hours	Count of hours in power-on state. The raw value of this attribute shows total count of hours (or minutes, or seconds, depending on manufacturer) in power-on state.
Temperature Celsius	The current temperature of the hard disk in degrees Celsius.
Reallocated Sector Count	Count of reallocated sectors. When the hard drive finds a read/write/verification error, it marks this sector as "reallocated" and transfers data to a special reserved area (spare area). This process is also known as remapping and "reallocated" sectors are called remaps. This is why, on a modern hard disks, you cannot see "bad blocks" while testing the surface - all bad blocks are hidden in reallocated sectors. However, the more sectors that are reallocated, the more a decrease (up to 10% or more) can be noticed in disk read/write speeds.
Current Pending Sector	Current count of unstable sectors (waiting for remapping). The raw value of this attribute indicates the total number of sectors waiting for remapping. Later, when some of these sectors are read successfully, the value is decreased. If errors still occur when reading sectors, the hard drive will try to restore the data, transfer it to the reserved disk area (spare area), and mark this sector as remapped. If this attribute value remains at zero, it indicates that the quality of the corresponding surface area is low.
Test Type	Set short or long time to test.
Test Result	Result of the test.
Test Time	Total time of the test.

- **Bad Block Scan**

On the Disk Information screen, select a disk then click on "Detect Bad Block" to perform bad block scan of the associated disk. The result is only for reference and the system will not take any action from its results.



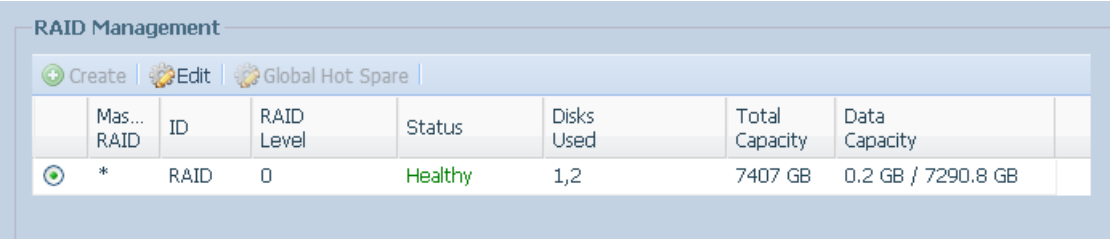
The bad block scan can be terminated by clicking on "Stop Detect Bad Block".



3.4.2 RAID Information

From the Storage menu, choose the RAID Management item and the RAID Management screen appears.

This screen lists the RAID volumes currently residing in the Thecus IP storage. From this screen, you can get information about the status of your RAID volumes, as well as the capacities allocated for data.



RAID Information	
Item	**Description**
Master RAID	The RAID volume currently designated as the Master RAID volume.
ID	ID of the current RAID volume. NOTE: All RAID IDs must be unique.
RAID Level	Shows the current RAID configuration.
Status	Indicates status of the RAID. Can read either ***Healthy***, ***Degraded***, or ***Damaged***.
Disks Used	Hard disks used to form the current RAID volume.
Total Capacity	Total capacity of the current RAID.
Data Capacity	Indicates the used capacity and total capacity used by user data.

- **Create a RAID**

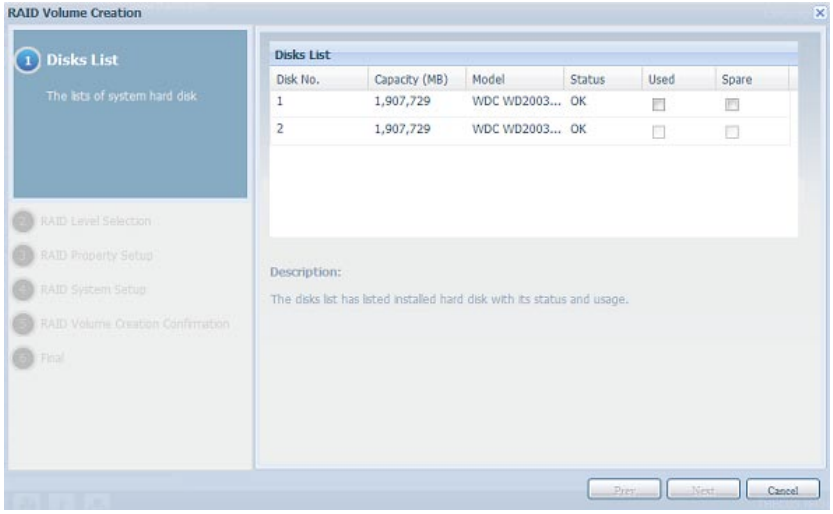
On the RAID Information screen, press the Create button to go to the RAID Volume Creation screen. In addition to RAID disk information and status, this screen lets you make RAID configuration settings.

Using Create RAID, you can select stripe size, choose which disks are RAID disks or the Spare Disk. .

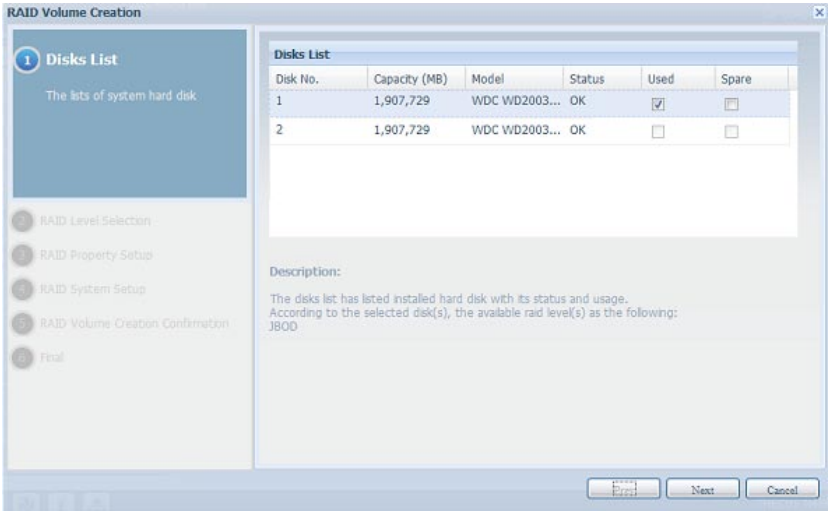
RAID Configurations	
Item	**Description**
Disk No.	Number assigned to the installed hard disks.
Capacity (MB)	Capacity of the installed hard disks.
Model	Model number of the installed hard disks.
Status	Status of the installed hard disks.
Used	If this is checked, current hard disk is aalready part of a RAID volume.
Spare	If this is checked, current hard disk is designated as a spare for a RAID volume.
Master RAID	Check a box to designate this as the Master RAID volume. See the NOTE below for more information.
Stripe Size	This sets the stripe size to maximize performance of sequential files in a storage volume. Keep the 64K setting unless you require a special file storage layout in the storage volume. A larger stripe size is better for large files.
Data Percentage	The percentage of the RAID volume that will be used to store data.
Create	Press this button to configure a file system and create the RAID storage volume.

To create a RAID volume, follow the steps below:

1. On the RAID Information screen, clicks create.



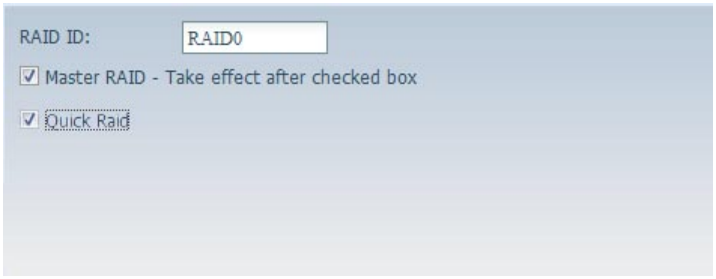
2. On the RAID Configuration screen, set the RAID storage space as JBOD, RAID 0, RAID 1, RAID 5, RAID 6 or RAID 10 (depends on model)— see Appendix B: RAID Basics for a detailed description of each.



3. Specify a RAID ID.

4. If this RAID volume is meant to be the Master RAID volume, tick the Master RAID checkbox.

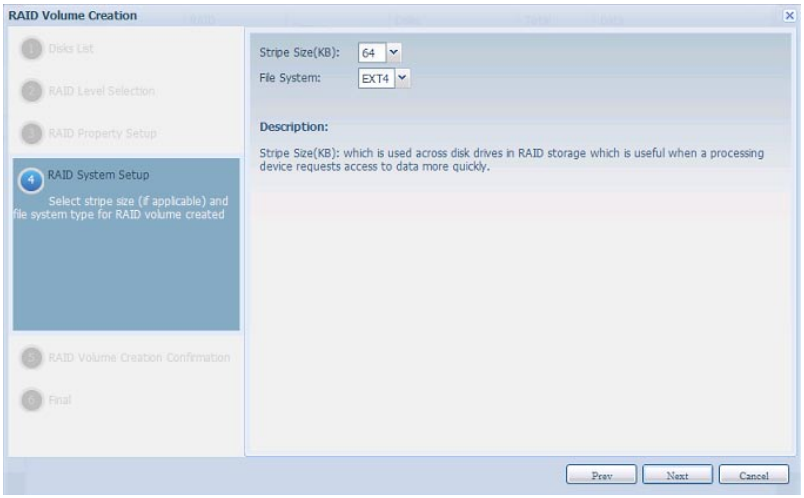
5. Quick RAID — Enabled the quick RAID setting is going to enhance RAID creation time.



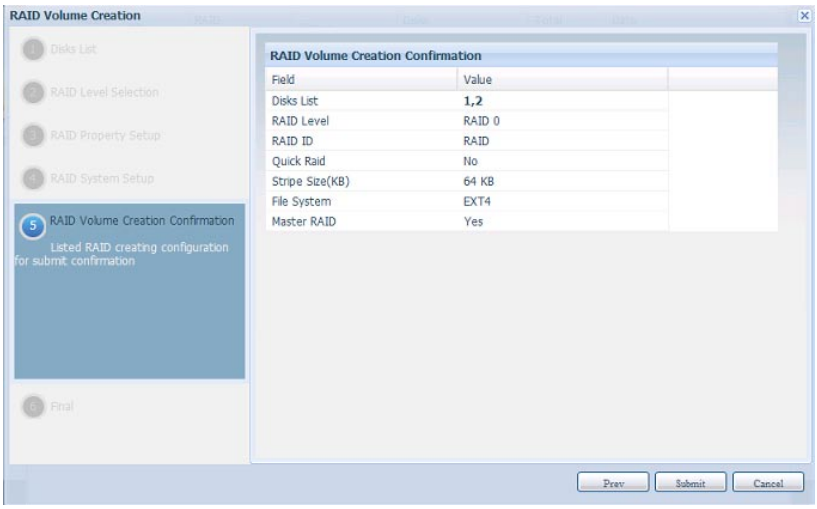
We recommend using the "Quick RAID" setting only if the hard disks are brand new or if no existing partitions are contained.

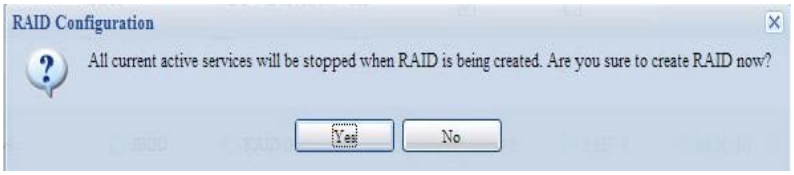
6. Specify a stripe size — 64K is the default setting.

7. Selected the file system you would like to have for this RAID volume. .

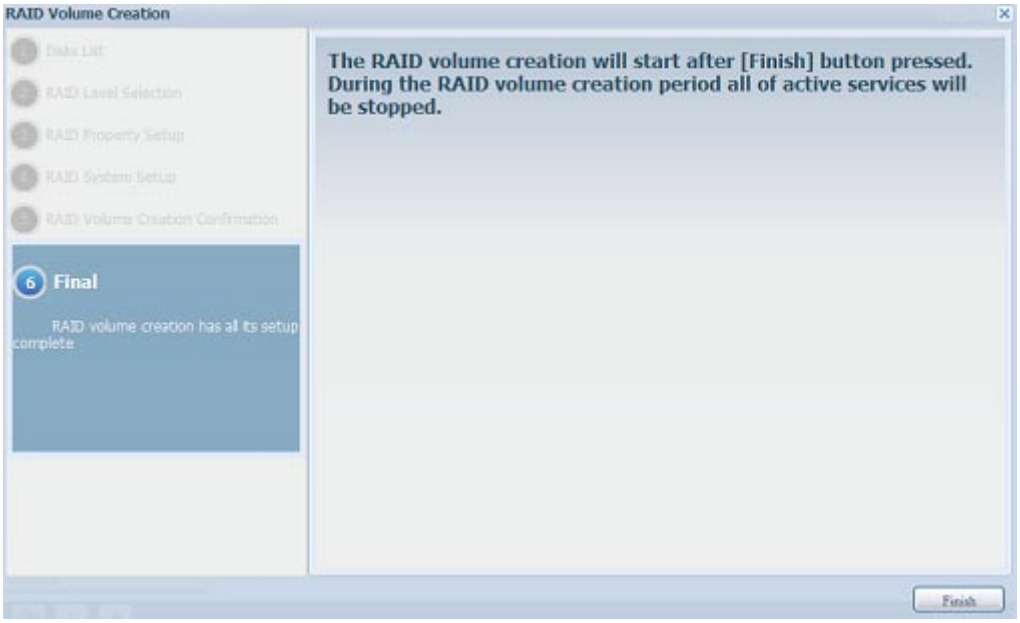

RAID Volume Creation
Disks List
RAID Level Selection
RAID Property Setup
RAID System Setup
Select stripe size (if applicable) and file system type for RAID volume created
RAID Volume Creation Confirmation
Final
Stripe Size(KB): 64
File System: EXT4
Description:
Stripe Size(KB): which is used across disk drives in RAID storage which is useful when a processing device requests access to data more quickly.
Prev
Next
Cancel

8. Press Submit to build the RAID storage volume.




RAID Configuration
All current active services will be stopped when RAID is being created. Are you sure to create RAID now?
Yes
No

9. Press "Yes" for RAID volume creation preparation. Then click "Finish" to start up with RAID volume building.


RAID Volume Creation
The RAID volume creation will start after [Finish] button pressed. During the RAID volume creation period all of active services will be stopped.
6 Final
RAID volume creation has all its setup complete
Finish

Building a RAID volume may be time consuming, depending on the size of hard drives and RAID mode. In general, if the RAID volume building process is up to "RAID Building", then the data volume is accessible.

Creating RAID destroys all data in the current RAID volume. The data will be unrecoverable.

- **RAID Level**

You can set the storage volume as JBOD, RAID 0, RAID 1, RAID 5, RAID 6, or RAID 10 (depending on model).

Level / Model	JBOD	RAID 0	RAID 1	RAID 5	RAID 6	RAID 10
N2310	•	•	•			

RAID configuration is usually required only when you first set up the device. A brief description of each RAID setting follows:

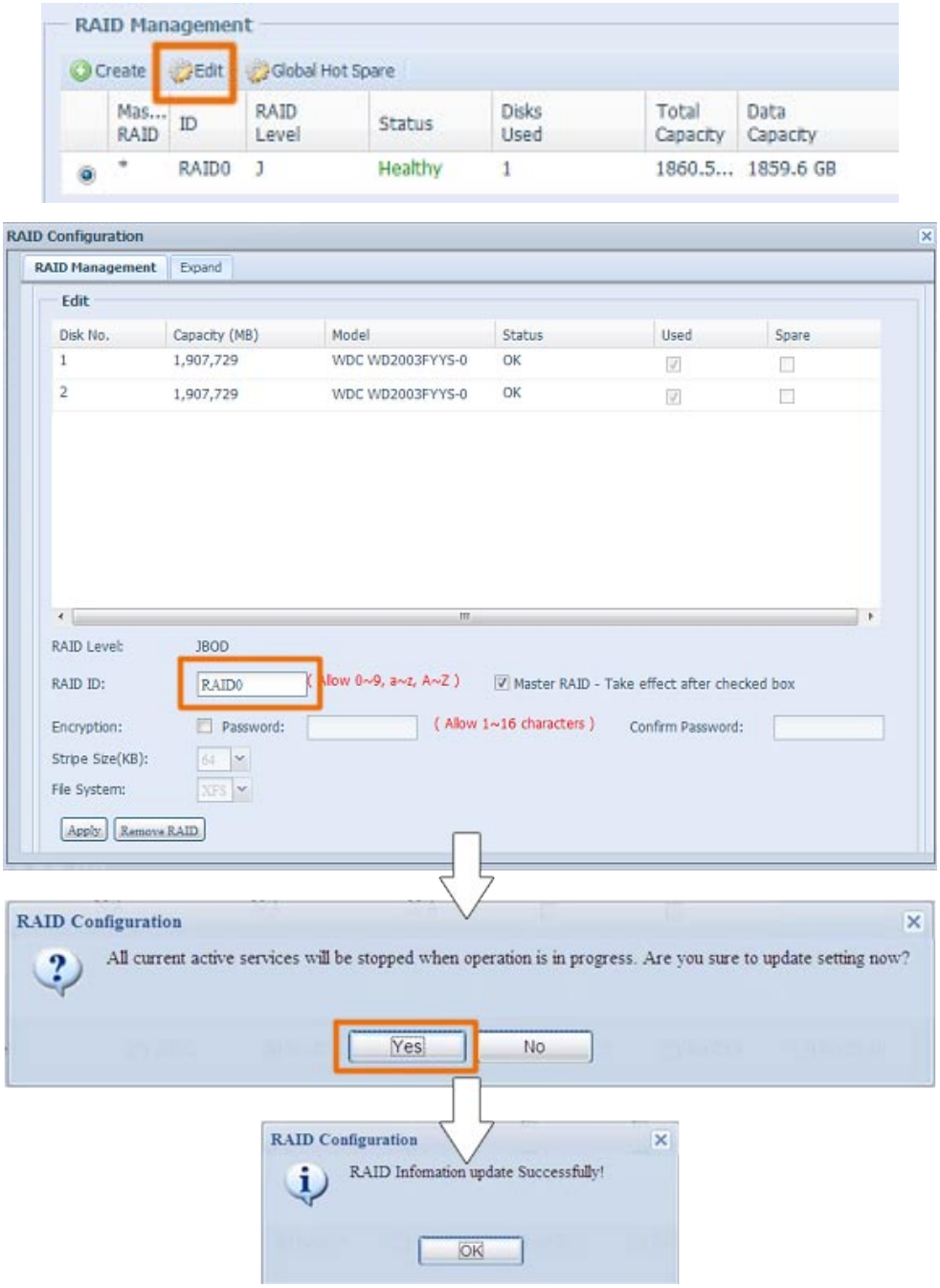
RAID Levels	
Level	**Description**
JBOD	The storage volume is a single HDD with no RAID support. JBOD requires a minimum of 1 disk.
RAID 0	Provides data striping but no redundancy. Improves performance but not data safety. RAID 0 requires a minimum of 2 disks.
RAID 1	Offers disk mirroring. Provides twice the read rate of a single disk, but same write rate. RAID 1 requires a minimum of 2 disks.
RAID 5	Data striping and stripe error correction information provided. RAID 5 requires a minimum of 3 disks. RAID 5 can sustain one failed disk.
RAID 6	Two independent parity computations must be used in order to provide protection against double disk failure. Two different algorithms are employed to achieve this purpose. RAID 6 requires a minimum of 4 disks. RAID 6 can sustain two failed disks.
RAID 10	RAID 10 has high reliability and high performance. RAID 10 is implemented as a striped array whose segments are RAID 1 arrays. It has the fault tolerance of RAID 1 and the performance of RAID 0. RAID 10 requires 4 disks. RAID 10 can sustain two failed disks.

Creating RAID destroys all data in the current RAID volume. The data will be unrecoverable.

- **Edit RAID**

On the RAID Information screen, press the Edit button to go to the RAID Information screen.

Using Edit RAID, you can select RAID ID and the Spare Disk.

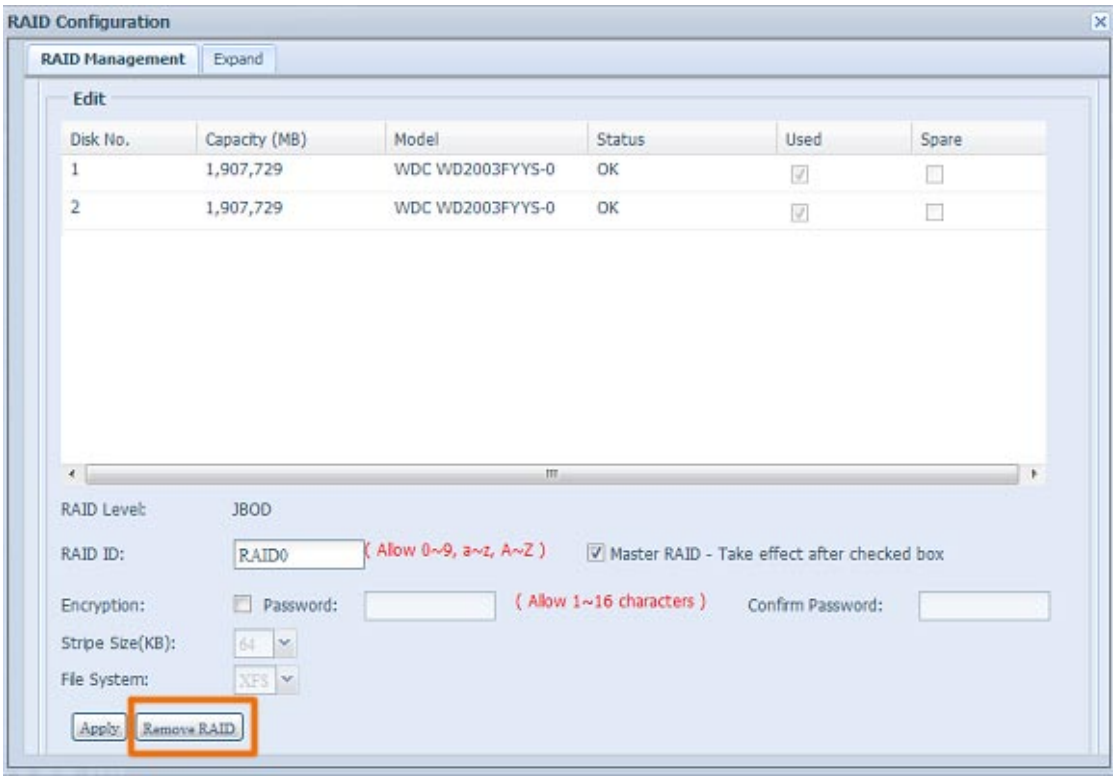


- **Remove RAID**

Click to remove the RAID volume. All user data created in the selected RAID volume will be deleted.

To remove a RAID volume, follow the steps below:

1. On the RAID List screen, select the RAID volume by clicking on its radio button, and click RAID Information to open the RAID Configuration screen.
2. On the RAID Configuration screen, click Remove RAID.
3. A confirmation screen will appear, you will have to click "Yes" to complete the "Remove RAID" operation.



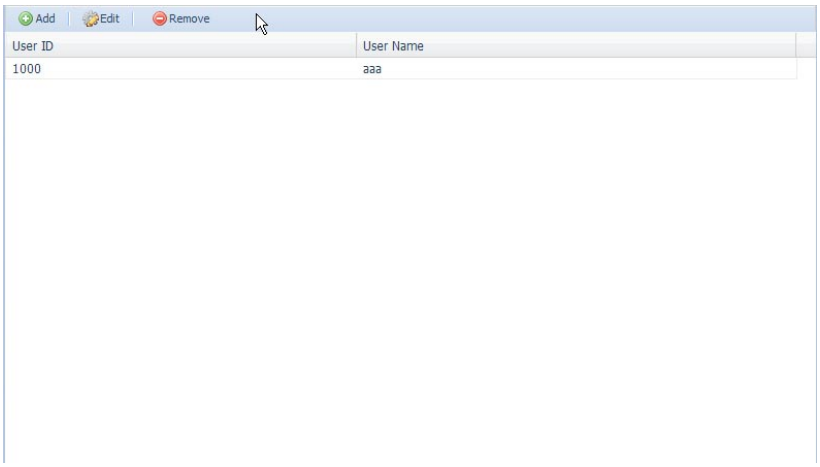
Remove RAID destroys all data in the selected RAID volume. The data will be unrecoverable.

3.5 File Sharing/Privilege

The Thecus IP storage has built-in user database that allows administrators to manage user access using different group policies. From the File Sharing/Privilege menu, you can create, modify, and delete users, and assign them to groups that you designate.

3.5.1 Local User Configuration

From the File Sharing/Privilege menu, choose the User item, and the Local User Configuration screen appears. This screen allows you to Add, Edit, and Remove local users.

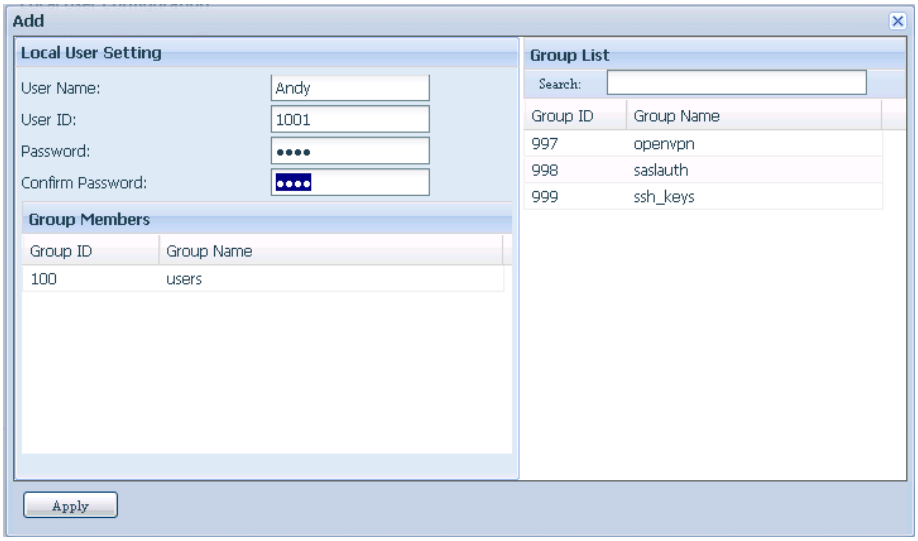


Local User Configuration	
Item	**Description**
Add	Press the ***Add*** button to add a user to the list of local users.
Edit	Press the ***Edit*** button to modify a local user.
Remove	Press the ***Remove*** button to delete a selected user from the system.

- **Add Users**

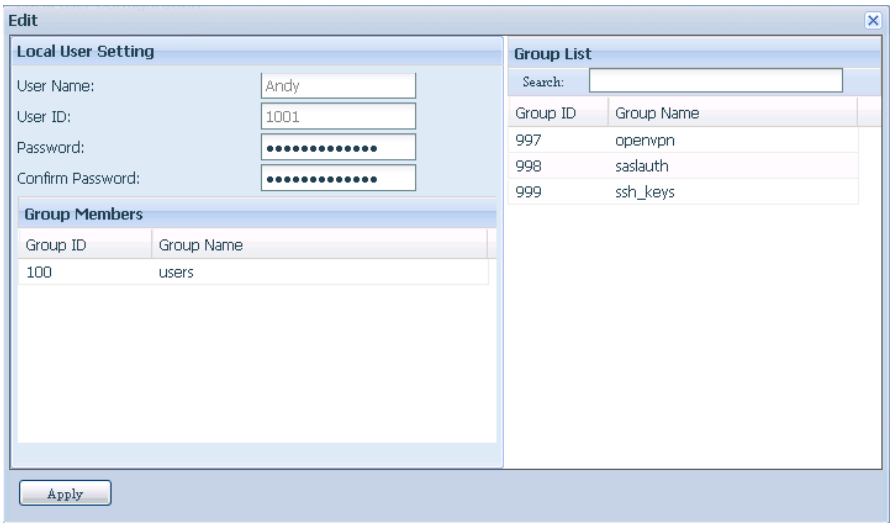
1. Click on the Add button on Local User Configuration screen, and Local User Setting screen appears.
2. On the Local User Setting screen, enter a name in the User Name box.
3. Enter a User ID number or leave blank to use the system default value.
4. Enter a password in the Password box and re-enter the password in the Confirm box.
5. Select which group the user will belong to. Group Members is a list of groups this user belongs to. Group List is a list of groups this user does not belong to. Use the << or >> buttons to have this user join or leave a group.
6. Press the Apply button and the user is created.

- All users are automatically assigned to the 'users' group.



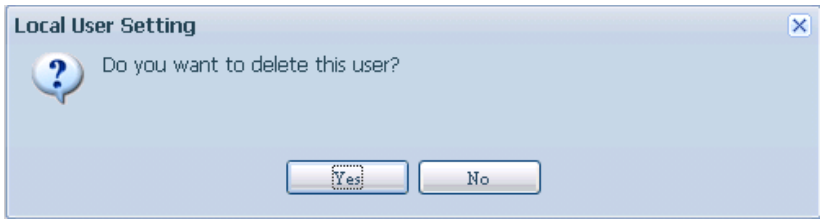
- **Edit Users**

1. Select an existing user from the Local User Configuration screen.
2. Click on the Edit button, and the Local User Setting screen appears.
3. From here, you can enter a new password and re-enter to confirm, or use the << or >> buttons to have this user join or leave a group. Click the Apply button to save your changes.



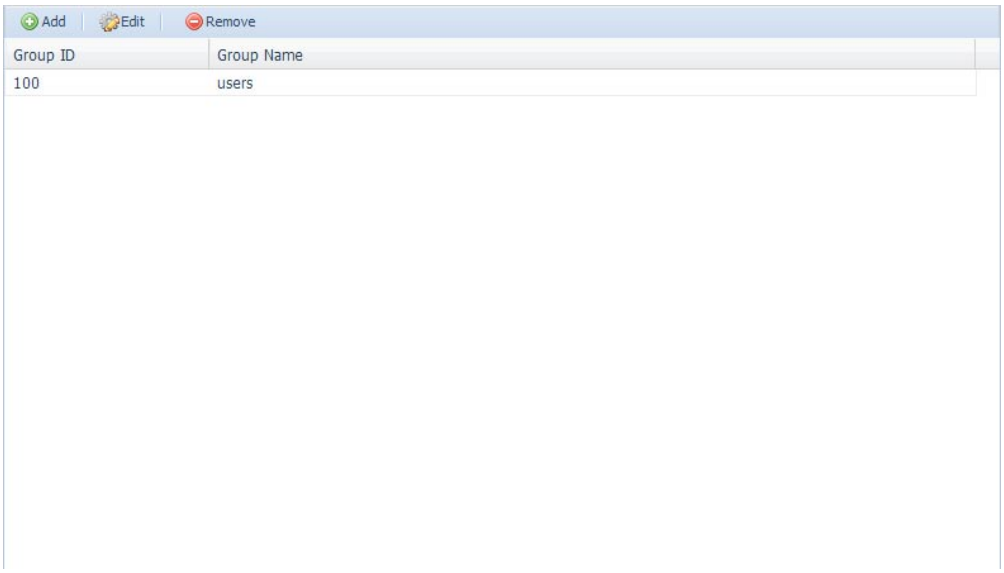
- **Remove Users**

1. Select an existing user from the Local User Configuration screen.
2. Click on Remove button and the user is deleted from the system.



3.5.2 Local Group Configuration

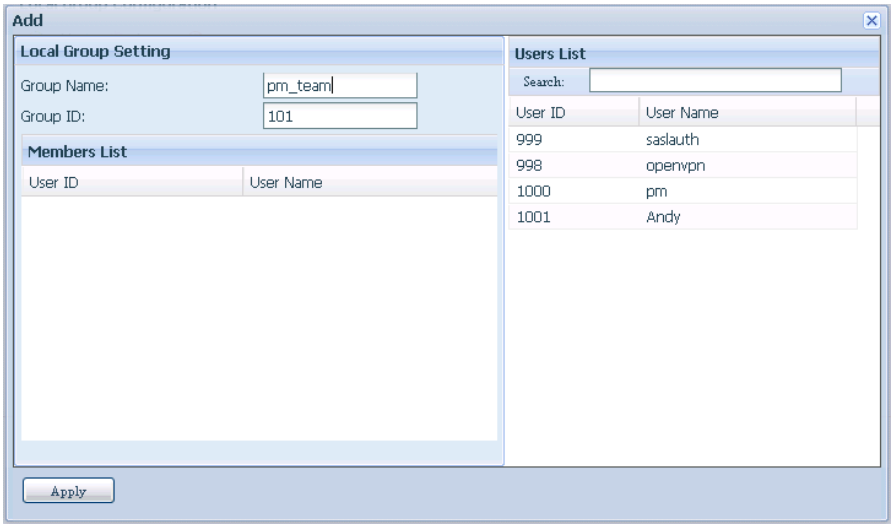
From the File Sharing/Privilege menu, choose the Group item, and the Local Group Configuration screen appears. This screen allows you to Add, Edit, and Remove local groups.



Local Group Configuration	
Item	**Description**
Add	Press the ***Add*** button to add a user to the list of local groups.
Edit	Press the ***Edit*** button to modify a selected group from the system.
Remove	Press the Remove button to delete a selected group from the system.

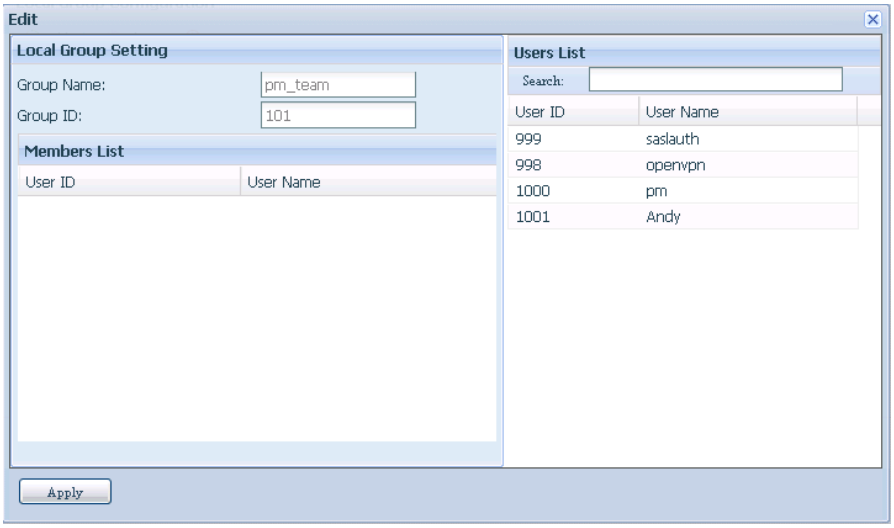
- **Add Groups**

1. On the Local Group Configuration screen, click on the Add button.
2. The Local Group Setting screen appears.
3. Enter a Group Name.
4. Enter a Group ID number. If left blank, the system will automatically assign one.
5. Select users to be in this group from the Users List by adding them to the Members List using the << button.
6. Click the Apply button to save your changes.



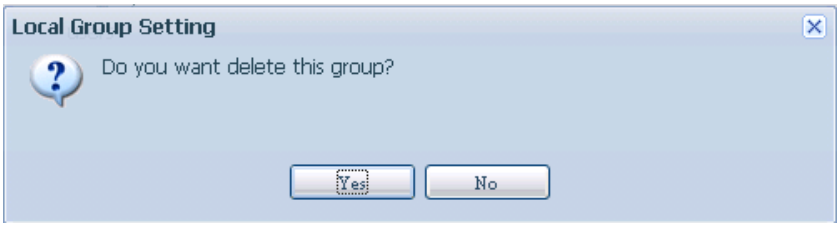
- **Edit Groups**

1. On the Local Group Configuration screen, select a group name from the list.
2. Press the Edit button to modify the members in a group.
3. To add a user into a group, select the user from the Users List, and press the << button to move the user into the Members List.
4. To remove a user from a group, select the user from Members List, and press the >> button.
5. Click the Apply button to save your changes.



- **Remove Groups**

1. On the Local Group Configuration screen, select a group name from the list.
2. Press Remove to delete the group from the system.



3.5.3 Batch Users and Groups Creation

The Thecus IP storage can also add users and groups in batch mode. This enables you to conveniently add numerous users and groups automatically by importing a simple comma-separated plain text (*.txt) file.

From the File Sharing/Privilege menu, click Batch Input and the Batch User and Group Creation dialogue will appear. To import your list of users and groups, follow these steps:

1. Click the Browse icon to locate your comma-separated text file.
   The information in the text file should follow this format:
   [USERNAME], [PASSWORD], [GROUP]
2. Click Open.
3. Click Import to begin the user list import.

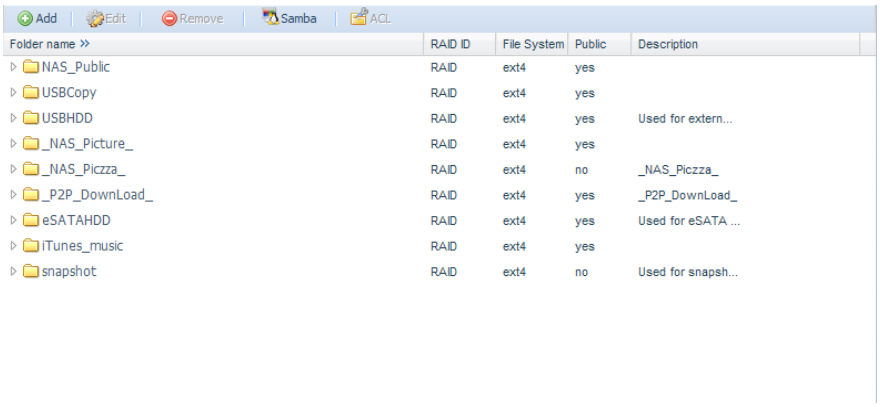
Batch User and Group Creation
Please choose a file to upload.
Import
Apply
Description
Submit files containing user names, passwords,
and group names separated by commas without any spaces,
each line represents one user.
(ex. Student1,password1,student_group)

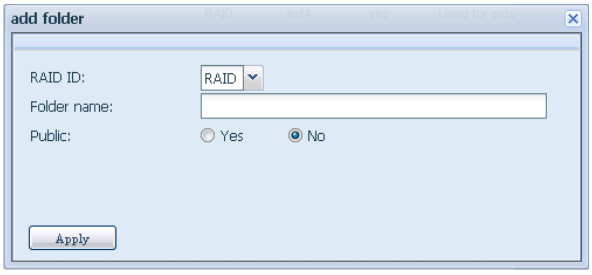
3.5.4 Share Folder

From the File Sharing/Privilege menu, choose Share Folders, and the Shared Folder screen appears. This screen allows you to create and configure folders on the Thecus IP storage volume.

- **Adding Folders**

On the Folder screen, press the Add button and the Add Folder screen appears. This screen allows you to add a folder. After entering the information, press Apply to create new folder.



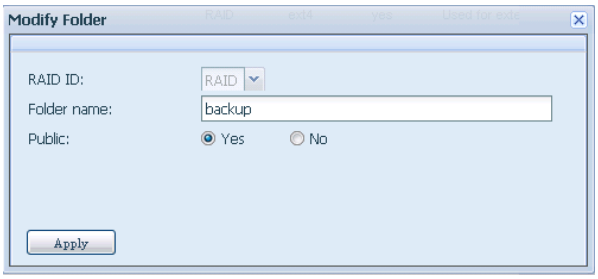


Add Folder	
Item	**Description**
RAID ID	RAID volume where the new folder will reside.
Folder Name	Enter the name of the folder.
Public	Admit or deny public access to this folder.
Apply	Press ***Apply*** to create the folder.

- **Modify Folders**

On the Folder screen, press the Edit button and the Modify Folder screen appears. This screen allows

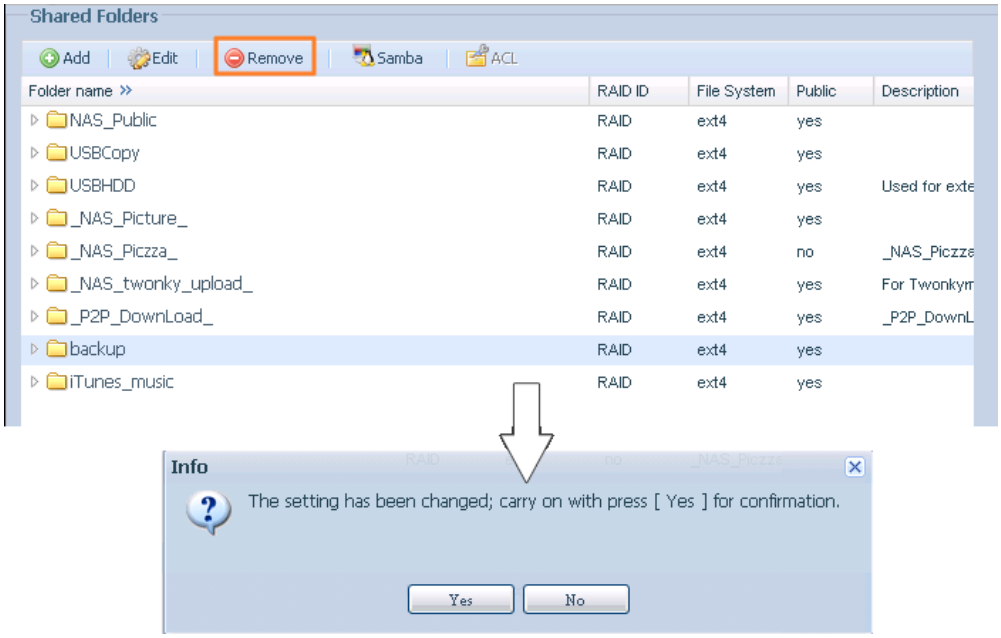
you to change folder information. After entering the information, press Apply to save your changes.



Modify Folder	
Item	**Description**
Folder Name	Enter the name of the folder.
Public	Admit or deny public access to this folder.
Apply	Press ***Apply*** to create the folder.

- **Remove Folders**

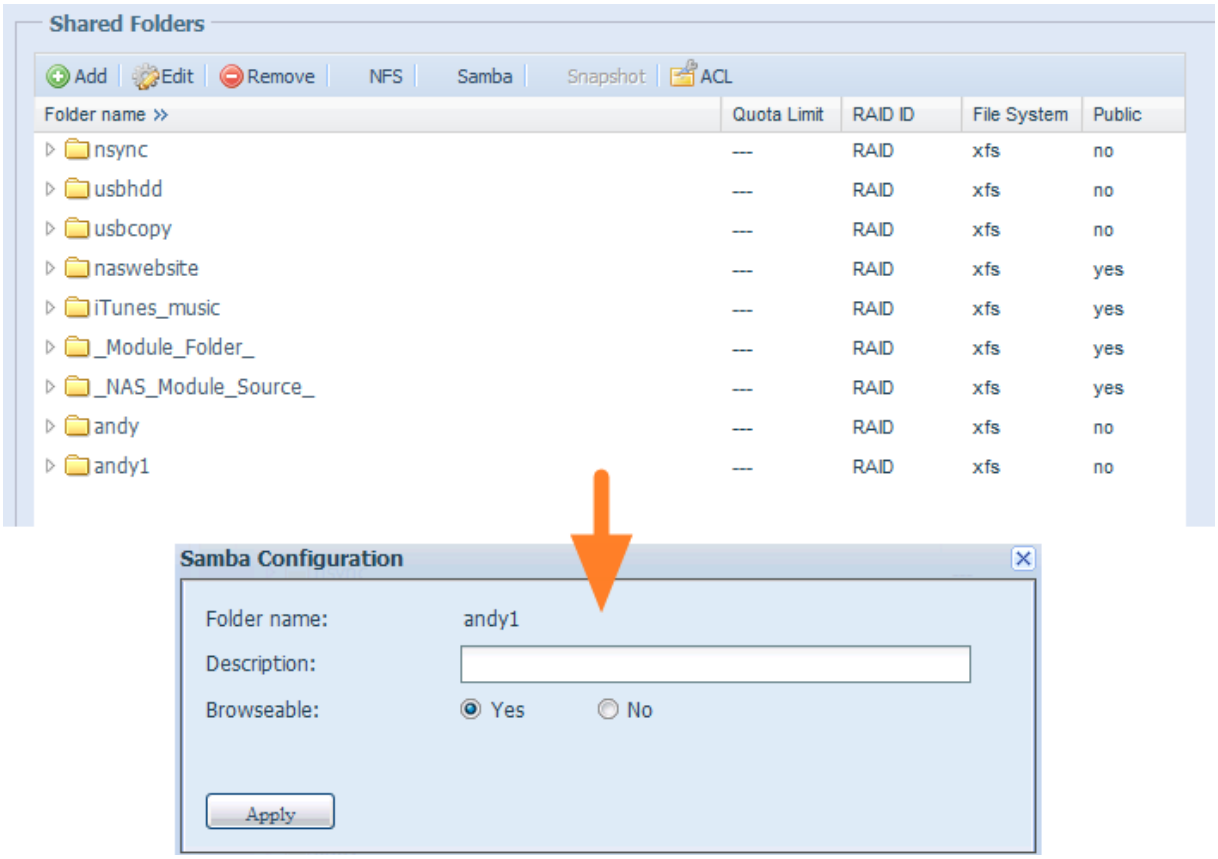
To remove a folder, press the Remove button from the specified folder row. The system will confirm folder deletion. Press Yes to delete the folder permanently or No to go back to the folder list.



All the data stored in the folder will be deleted once the folder is deleted. The data will not be recoverable.

- **Samba Configuration**

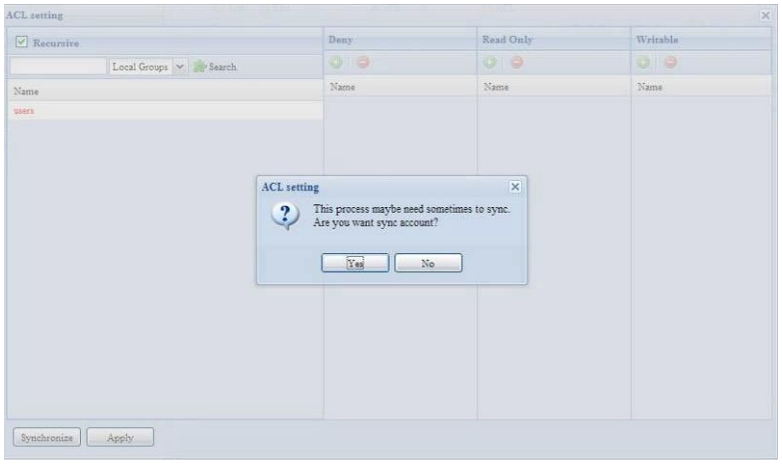
On the Folder screen, press the Samba button and the Samba Configuration screen appears. This screen allows you to setup samba configuration for associated folder. After entering the information, press Apply to activate input settings.

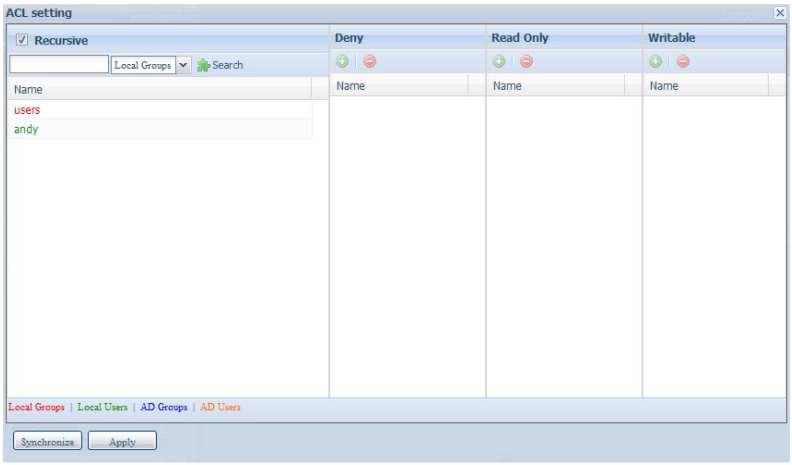


Samba Configuration	
Item	**Description**
RAID ID	RAID volume where the new folder will reside.
Folder Name	Enter the name of the folder.
Public	Admit or deny public access to this folder.
Apply	Press ***Apply*** to create the folder.

- **Folder and sub-folders Access Control List (ACL)**

On the Folder screen, press the ACL button, and the ACL setting screen appears. This screen allows you to configure access to the specific folder and sub-folders for users and groups. Select a user or a group from the left hand column and then choose Deny, Read Only, or Writable to configure their access level. Press the Apply button to confirm your settings.





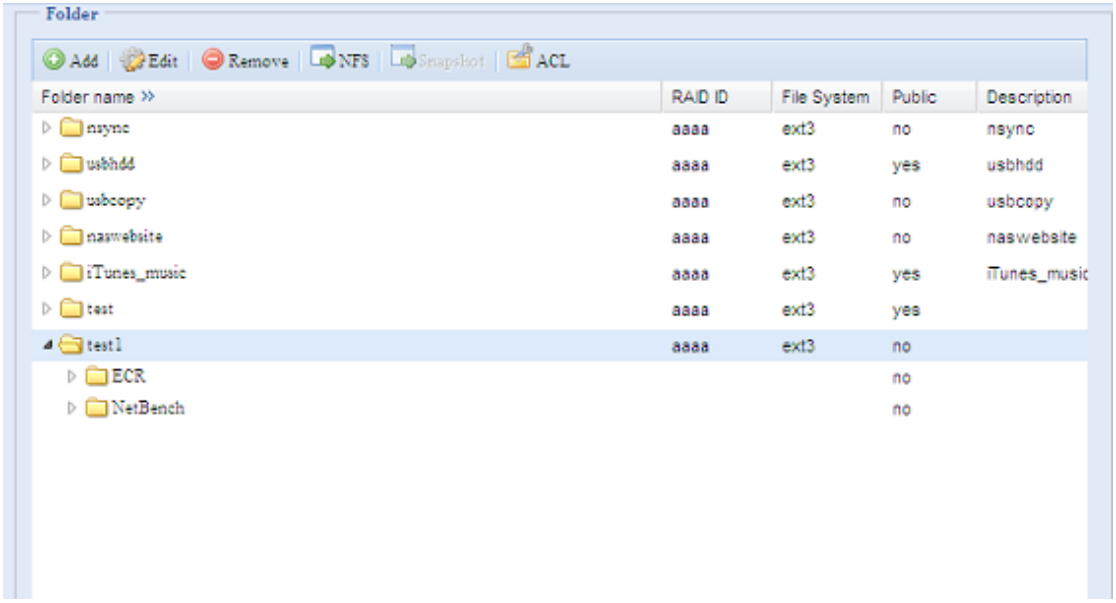
ACL setting	
Item	**Description**
Deny	Denies access to users or groups who are displayed in this column.
Read Only	Provides Read Only access to users or groups who are displayed in this column.
Writable	Provides Write access to users or groups who are displayed in this column.
Recursive	Enable to inherit the access right for all its sub-folders.

To configure folder access, follow the steps below:

1. On the ACL screen, all network groups and users are listed in the left hand column. Select a group or user from this list.
2. With the group or user selected, press one of the buttons from the three access level columns at the top. The group or user then appears in that column and has that level of access to the folder.
3. Continue selecting groups and users and assigning them access levels using the column buttons.
4. To remove a group or user from an access level column, press the Remove button in that column.
5. When you are finished, press Apply to confirm your ACL settings

If one user has belonged to more than one group with different privilege, then the priority of the privilege will be as followed:
Deny > Read Only > Writable

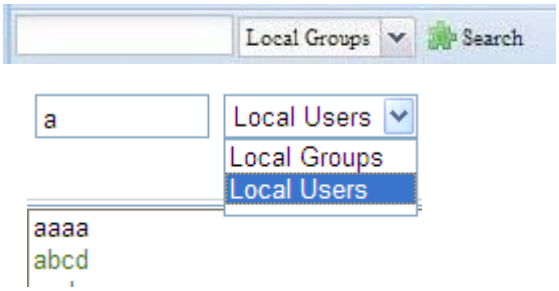
To setup sub-folders ACL, click on " ▷ " symbol to extract sub folders list as screen shot shows below. You may carry on with same steps as share level ACL setting.



The ACL can only be set for share and sub-folders level, not for files.

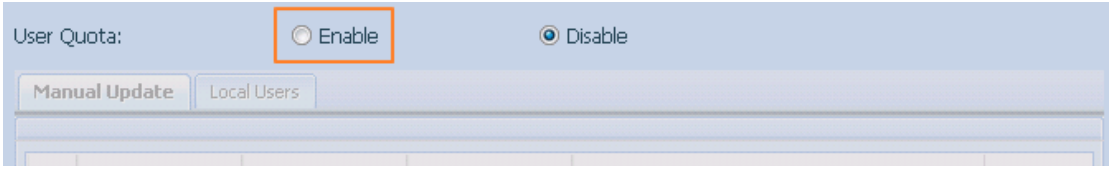
The ACL screen also allows you to search for a particular user. To do this, follow the steps below:

1. In the blank, enter the name of the user you would like to find.
2. From the drop down select the group you would like to search for the user in.
3. Click Search.

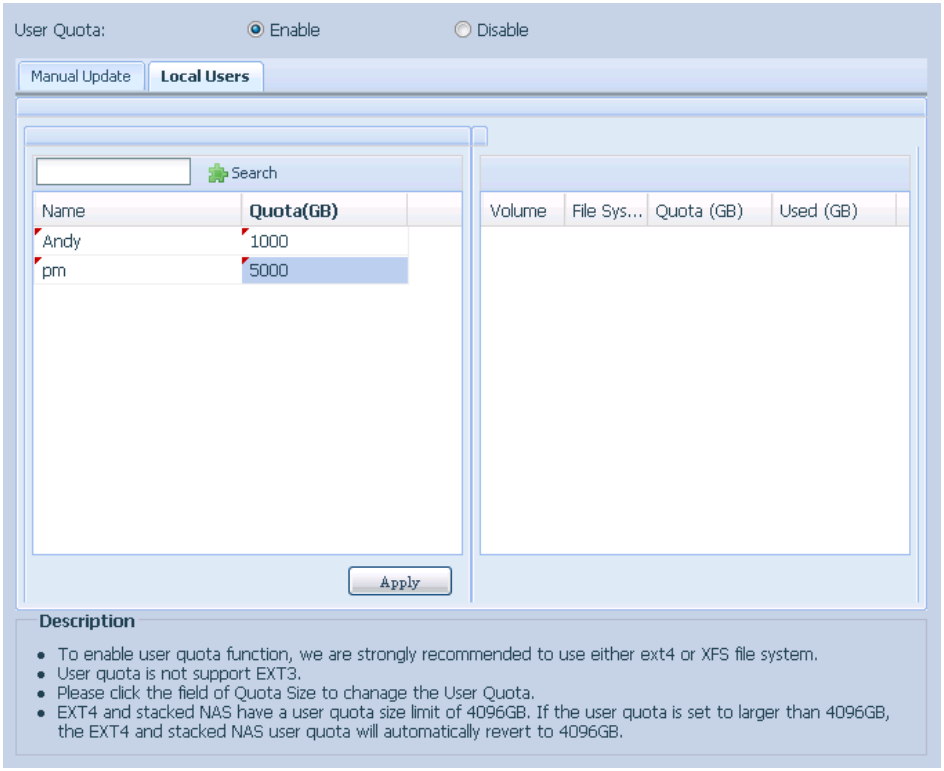


3.5.5 User Quota

The Thecus IP storage support local or AD users with storage quota limitations in each RAID volume of the system. To enable this function, simply click "Enable", then apply.



Next, each user can be setup a global storage quota size for each RAID volume. Simply click on "Quota Size" for each user and input the desired capacity. After the setup is complete, please click on "Apply" to activate the user quota size.


User Quota:
Enable
Disable
Manual Update
Local Users
Search
Name
Quota(GB)
Andy
1000
pm
5000
Volume
File Sys...
Quota (GB)
Used (GB)
Apply
Description
To enable user quota function, we are strongly recommended to use either ext4 or XFS file system.
User quota is not support EXT3.
Please click the field of Quota Size to chanage the User Quota.
EXT4 and stacked NAS have a user quota size limit of 4096GB. If the user quota is set to larger than 4096GB, the EXT4 and stacked NAS user quota will automatically revert to 4096GB.

3.5.6 User and Group Backup

The user and group backup feature allow system users and groups to be backed up to another location and be restored if needed.

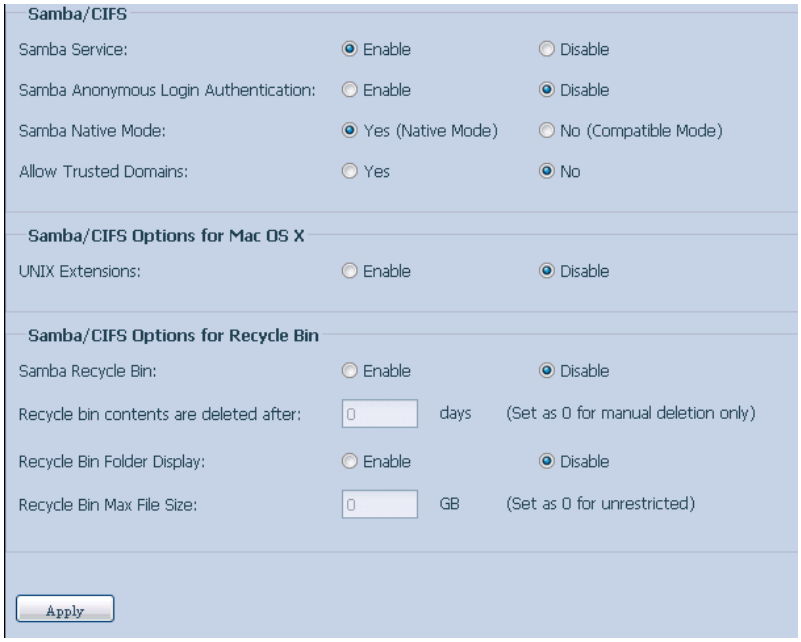
Please note, when restoring previous backup users and groups, the current users and groups list will be replaced from this restore file's contents.

3.6 Network Service

Use the Network Service menu to make network service support settings.

3.6.1 Samba / CIFS

There are options allow Admin to Enable/Disable to operate Thecus IP storage associated with Samba / CIFS protocol. With the option changed, it will need to reboot system to activate.



- **Samba Service**

Used for letting the operating system of UNIX series and SMB/CIFS of Microsoft Windows operating system (Server Message Block / Common Internet File System).Do the link in network protocol. Enable or Disable SMB/CIFS protocol for Windows, Apple, Unix drive mapping

. In some environments, due to security concerns, you may wish to disable SMB/CIFS as a precaution against computer viruses.

- **Samba Anonymous Login Authentication**

To enable this option, no matter there is share folder has been created in public access. The user account and password is needed from system to access under SMB/CIFS protocol. On the other hand, no more anonymous login is allowed.

- **Samba is Native mode**

The Thecus IP storage is supported Samba mode options. In the ADS environment with "Native" mode selected then Thecus IP storage is capable to become local master position.

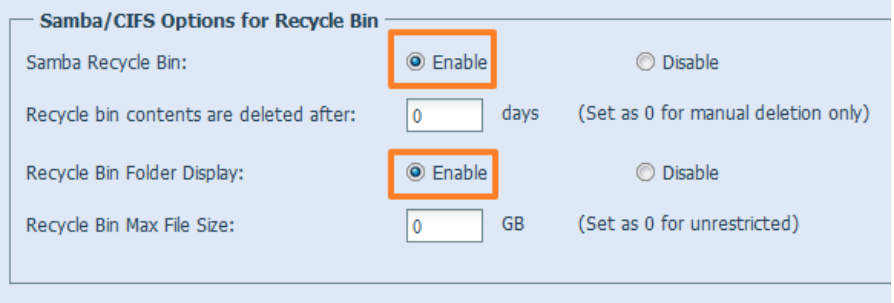
- **UNIX Extension**

The default is enable for Samba usage, with situation using Mac OSX with smb connection may have permission issue. When it happened, please setup "UNIX Extension" disable to get issue solved.

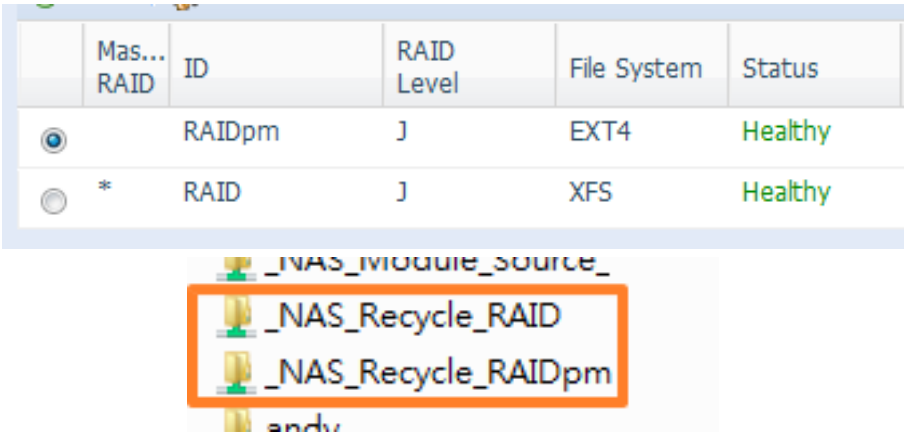
- **Samba Recycle Bin**

The Thecus IP storage is supported recycle bin via SMB/CIFS protocol.

Simply enable the "Recycle Bin" function and "Recycle Folder Display" then all of deleted files/folders will reside in the "_NAS_Recycle_(Associated RDID Volume)" share folder.



For example, the system has created 2 RAID volumes with ID "RAIDpm" and 'RAID". Then it will have 2 recycle bin folder appear as "_NAS_Recycle_RAID" and "_NAS_Recycle_RAIDpm".



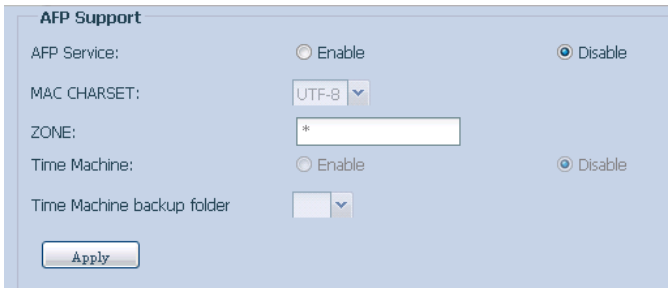
There are 2 more setting could help to manage the recycle bin for deleted folders/files.

1. Setup the "Day" to remove deleted folders/files which has resided in recycle bin permanently. Left default value "0" if desired to clean up recycle bin manually.
2. Setup the "Size" for recycle bin to allow deleted folders/files can store. Left default value "0" with no limitation.

- The deleted files/folders which have resided in recycle bin will keep its permission. On the other hand, only the admin and owner can view/read/write these folders/files.
- If deleted single file size is large than 2GB then it won't reside in the recycle bin but erase permanently.

3.6.2 AFP (Apple Network Setup)

From the System Network menu, choose the AFP item, and the AFP Support screen appears. This screen displays the configuration items for the Apple Filing Protocol. You can change any of these items and press Apply to confirm your settings.

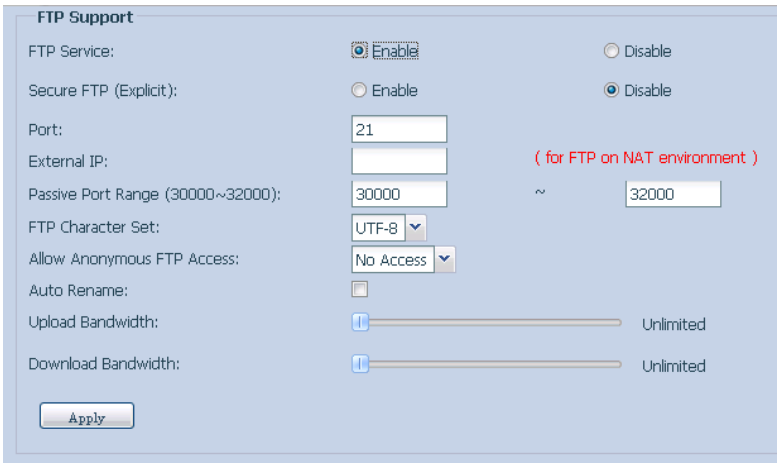


A description of each item follows:

Apple Network Configuration	
Item	**Description**
AFP Server	Enable or disable Apple File Service to use the Thecus IP storage with MAC OS-based systems.
MAC CHARSET	Specifies the code page from the drop down list.
Zone	Specifies Zone for Applet Talk service. If your AppleTalk network uses extended networks and is assigned with multiple zones, assign a zone name to the Thecus IP storage. If you do not want to assign a network zone, enter an asterisk (*) to use the default setting.
Time Machine	Click the enable checked box if you would like your MAC system to use the Thecus IP storage as MAC time machine backup.
Time Machine backup folder	Select from the drop down list to designate the folder for time machine backup destination.

3.6.3 FTP

The Thecus IP storage can act as an FTP server, enabling users to download and upload files with their favorite FTP programs. From the System Network menu, choose the FTP item, and the FTP screen appears. You can change any of these items and press Apply to confirm your settings.



A description of each item follows:

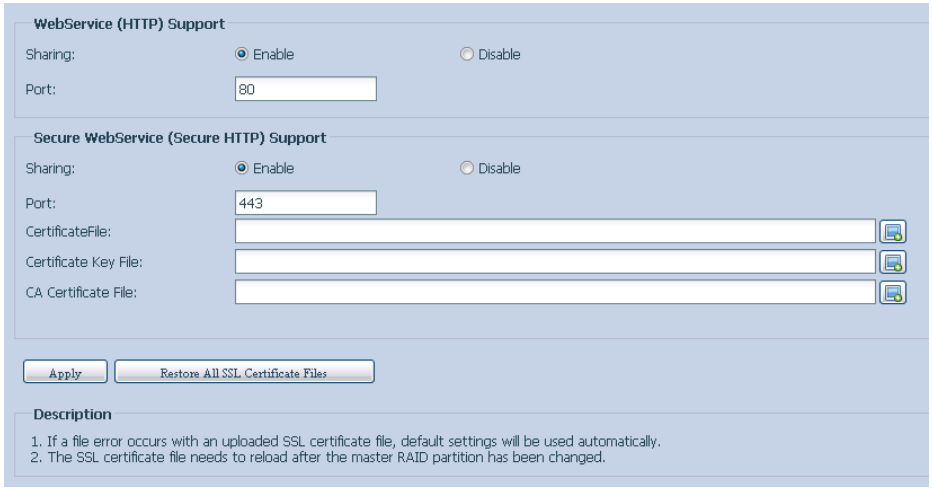
FTP	
Item	**Description**
FTP	Enables FTP Service on the Thecus IP storage.
Security FTP	Enable or disable Security FTP, be sure the client FTP software has also security FTP setting enabled.
Port	Specifies the port number of an incoming connection on a non-standard port.
External IP	Input the public IP address of the router when the Thecus secure FTP server has been enabled. This can help to respond to the ftp client with proper communication information.
Passive Port Range (30000-32000)	Limited port range for the FTP server to use.

FTP ENCODE	If your FTP client or operating system does not support Unicode (e.g. Windows® 95/98/ME or MAC OS9/8), select the same encoding as your OS here in order to properly view the files and directories on the server. Available options are BIG5, HZ, GB2312, GB18030, ISO, EUC-JP, SHIFT-JIS and UTF-8.
Allow Anonymous FTP Access	Upload/Download: Allow anonymous FTP users to upload or download files to/from public folders. Download: Allow anonymous FTP users to download files from public folders. No access: Block anonymous FTP user access.
Auto Rename	If checked, the system will automatically rename files that are uploaded with a duplicate file name. The renaming scheme is [filename].#, where # represents an integer.
Upload Bandwidth	You may set the maximum bandwidth allocated for file uploads. Selections include Unlimited, 1 ~ 32 MB/s.
Download Bandwidth	You may set the maximum bandwidth allocated for file downloads. Selections include Unlimited, 1 ~ 32 MB/s.

To access the share folder on the Thecus IP storage, use the appropriate user login and password set up on the Users page. Access control to each share folder is set up on the ACL page (Storage Management > Share Folder > ACL).

3.6.4 WebService

From the Network Service menu, choose the WebService item, and the WebService Support screen appears. This screen displays the service support parameters of the system. You can change any of these items and press Apply to confirm your settings.



A description of each item follows:

Web Service	
Item	**Description**
HTTP (WebDisk) Support	Enable or disable WebDisk support. Enter the port number if this option is enabled. The port number is default 80.
HTTPs (Secure WebDisk) Support	Enable or disable secure WebDisk support. Enter the port if this option is enabled.
Certificate Type	Select "User" if there is available Certification ID ex. Apply from VeriSign. Or using system default by select "System".
Certificate File	Upload Certificate File if choose Certificate type "User".
Certificate Key File	Upload Certificate Key File if choose Certificate type "User".
CA Certificate File	Upload CA Certificate File if choose Certificate type "User".
Restore All SSL Certificate Files	Click to set back to default certification details.
Apply	Click "Apply" to confirm the changes.

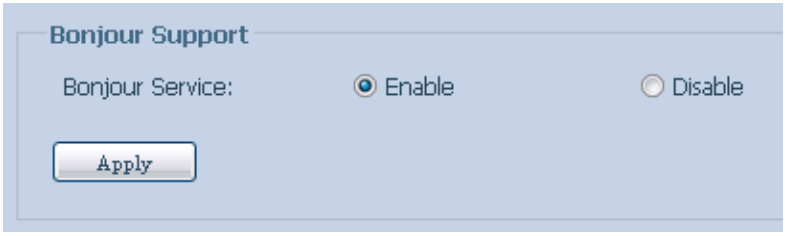
Disable HTTP support and Enable Secure HTTP support to guarantee secure access.

3.6.5 UPnP

This device supports UPnP Media server, which allows users to play media files with UPnP client (ex. DMA devices). Enable or disable Universal Plug and Play protocol. UPnP helps to find the IP address of Thecus IP storage.

3.6.6 Bonjour Setting

Bonjour, is Apple Inc.'s trade name for its implementation of Zeroconf, a service discovery protocol. Bonjour locates devices such as printers, as well as other computers, and the services that those devices offer on a local network using multicast Domain Name System service records. This definitive guide walks you through Bonjour zero-configuration networking with a complete description of the protocols and technologies used to create Bonjour enabled applications and devices.

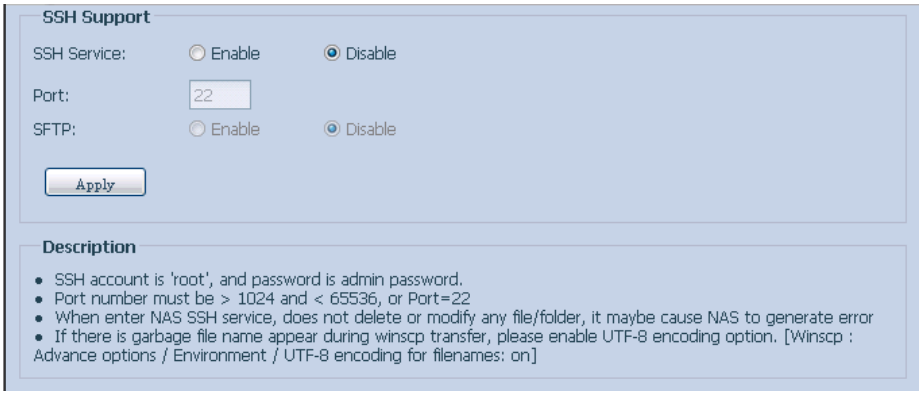


3.6.7 SSH

The device is now SSH protocol supported. It allows user to use SSH and have console to manipulate as needed. The SSH default login user name is "root" with full privilege and password is admin's password. The default admin password is "admin" so once the admin password has changed then SSH login need to change the password too.

A description for each item as following:

SSH	
Item	**Description**
SSH Service	Enable or disable SSH service.
Port	The port number is default 22.
SFTP	Enable or disable SFTP protocol under SSH service.
Apply	Click "Apply" to confirm the changes.


SSH Support
SSH Service:
Enable
Disable
Port:
22
SFTP:
Enable
Disable
Apply
Description
SSH account is 'root', and password is admin password.
Port number must be > 1024 and < 65536, or Port=22
When enter NAS SSH service, does not delete or modify any file/folder, it maybe cause NAS to generate error
If there is garbage file name appear during winscp transfer, please enable UTF-8 encoding option. [Winscp : Advance options / Environment / UTF-8 encoding for filenames: on]

3.6.8 DDNS

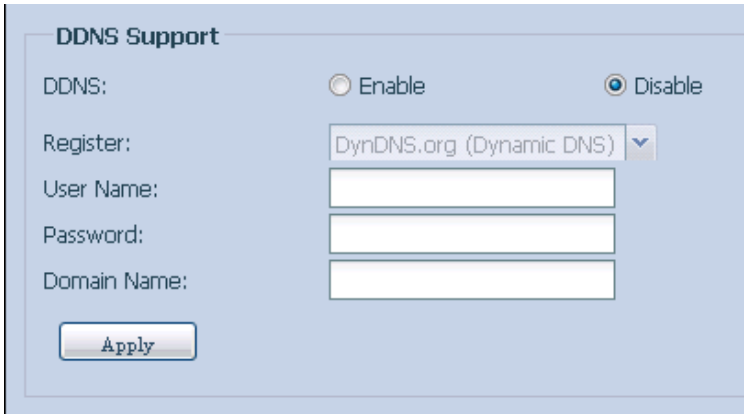
To set up a server on the Internet and enable the users to connect to it easily, a fixed and easy-to remember host name is often required. However, if the ISP provides only dynamic IP address, the IP address of the server will change from time to time and is difficult to recall. You can enable the DDNS service to solve the problem.

After enabling the DDNS service of the NAS, whenever the NAS restarts or the IP address is changed, the NAS will notify the DDNS provider immediately to record the new IP address. When the user tries to connect to the NAS by the host name, the DDNS will transfer the recorded IP address to the user.

The NAS supports the DDNS providers:

DyDNS.org(Dynamic DNS),DyDNS.org(Custom DNS),DyDNS.org(Static DNS),

www.zoneedit.com,www.no-ip.com.



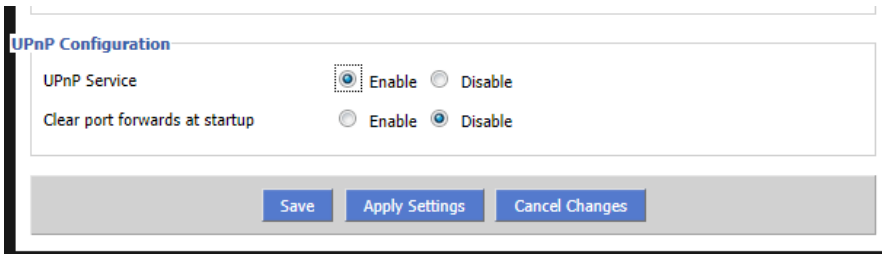
A description for each item as following:

DDNS	
Item	**Description**
DDNS Service	Enable or disable DDNS service.
Register	Choose the service provider from the drop down list.
User name	Input user name with DDNS registry.
Password	Input password with DDNS registry.
Domain name	Input domain name with DDNS registry.
Apply	Click "Apply" to confirm the changes.

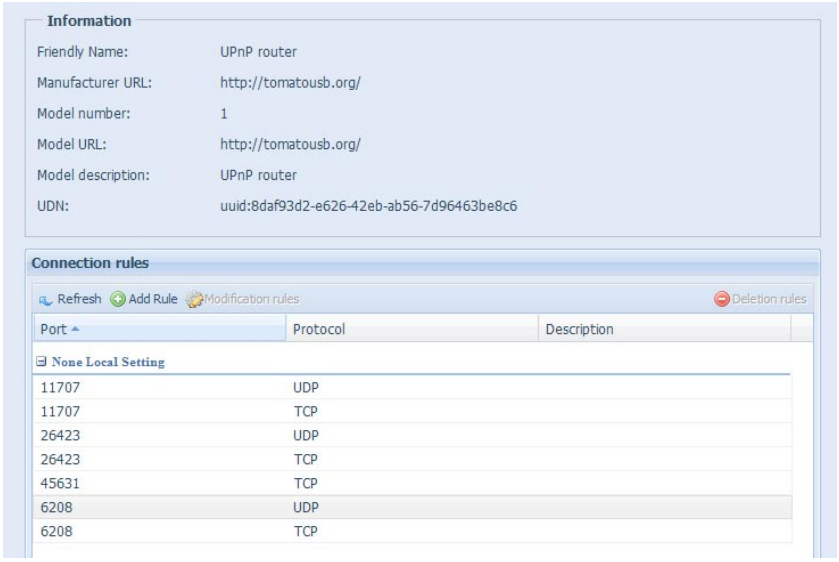
3.6.9 UPnP Port Management

One of the most convent way to allow users to access required services such as FTP, SSH, web disk and http etc. from Internet environment is setting UPnP port management.

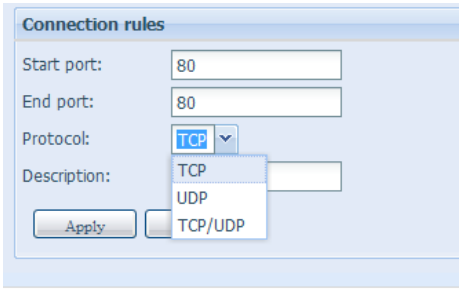
To set up this UPnP port forwarding feature, please be sure that the router has "UPnP Service" Enabled. The following is an example from one of the router manufacture with UPnP Configuration page.



After the router has enabled "UPnP Service" then you will have information come from associated router to UPnP port management as shown in the screen shot below.



And click "Add Rule" to add more port mapping from Internet to access desired services or press "Refresh" to get most updated list.



A description for each item as following:

UPnP Port Management	
Item	**Description**
Start port	Specific port number starts with.
End port	Specific port number ended
Protocol	Choose the protocol for port forwarding needed.
Description	Specific the port services if applicable.
Apply	Click "Apply" to confirm the changes.
Cancel	Click "Cancel" to abort the changes

Some of the routers do not allow the input of port number below 1024. So it may have resulted "setting fails".

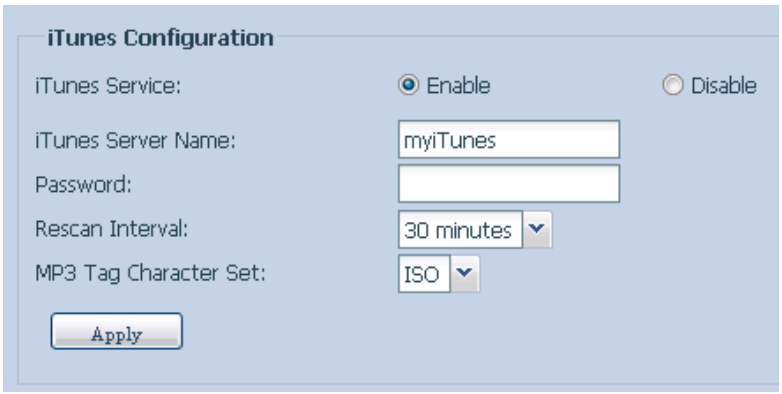
3.7 Application Server

The Thecus IP storage supports built-in application such as iTunes server as well as add-on official or third -party applications.

3.7.1 iTunes® Server (Built in)

With the built-in iTunes server capability, Thecus IP storage enables digital music to be shared and played anywhere on the network!

From the Network menu, choose the iTunes item, and then the iTunes Configuration screen appears. You may enable or disable the iTunes Service from here. Once enabled, enter the proper information for each field and press Apply to save your changes.



See the following table for a detailed description of each field:

iTunes Configuration	
Item	**Description**
iTunes Service	Enable or disable the iTunes Service.
iTunes Server Name	Name used to identify Thecus IP storage to iTunes clients.
Password	Enter a password to control access to your iTunes music.
Rescan Interval	Rescan interval in seconds.
MP3 Tag Encode	Specify tag encoding for MP3 files stored in Thecus IP storage. All ID3 tags will be sent out in UTF-8 format.

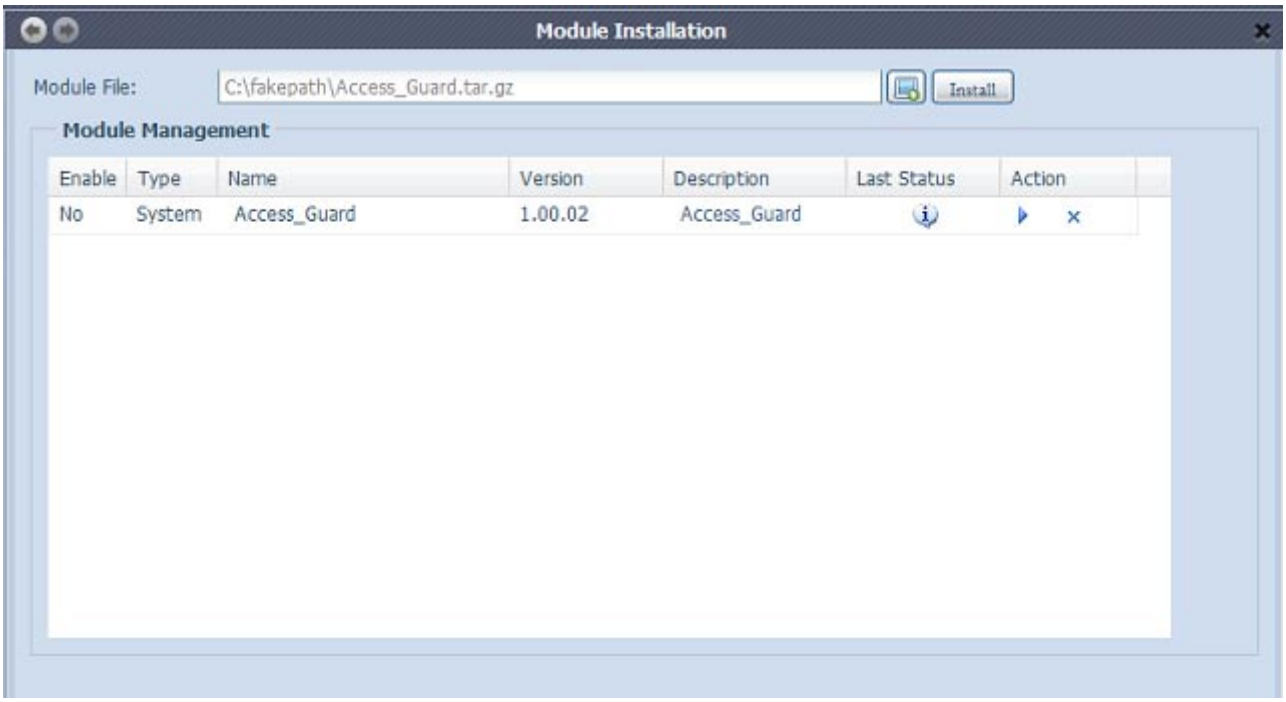
Once the iTunes service is enabled, Thecus IP storage will make all music located in the Music folder available for iTunes-equipped computers on the network.

3.7.2 Add-on Official Applications

There are several default pre-loaded official applications such as WebDisk, Piczza (Photo server) and Transmission-Kit (BT download manager) that can be found from the Application Server category.

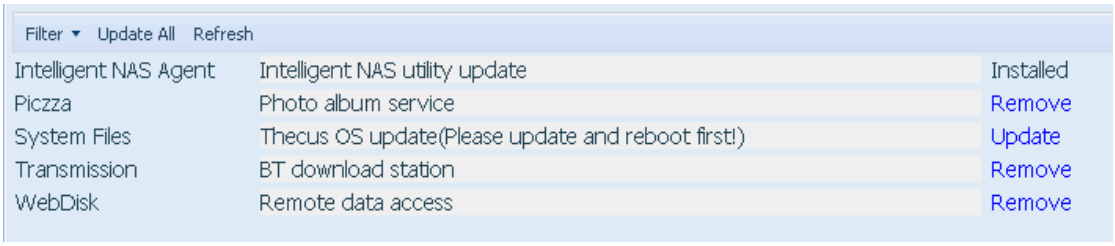
3.7.3 Module Installation

From the Application Server Category, choose the Module Installation item and the Module Management screen appears. Here is the entry for all of third party user module could install from.



3.7.4 NAS Application

Click on NAS Application from the Application Server category, it will list the current system software and official application status.



3.8 Backup

There are a number of ways to back up data with the Thecus IP storage.

3.8.1 Rsync Target Server

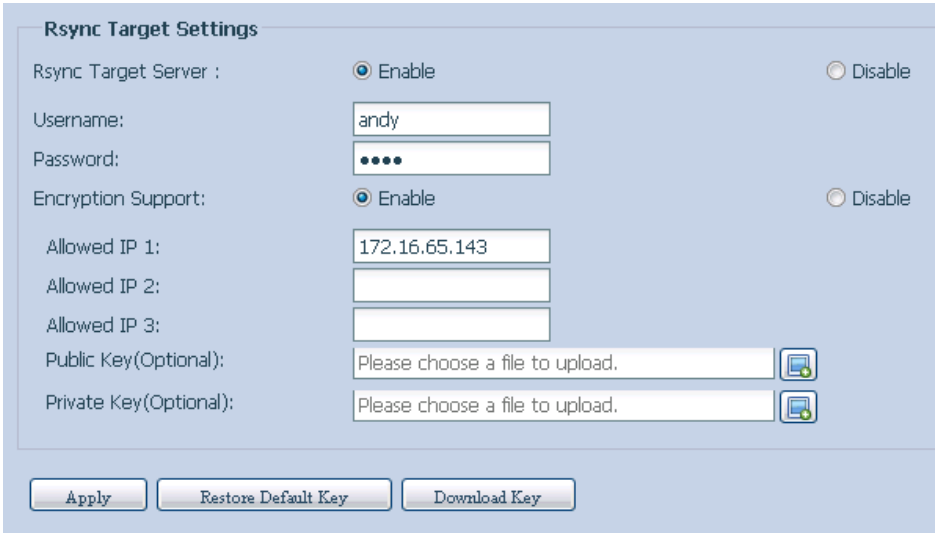
When it comes to backing up your data, it's very important to have flexibility. Data guard provides you with many options, including full backup for all shares, custom backup for selected shares volume backup. Being based on the Linux operating system, it is also much more stable and experiences much less frequent data loss during transfer than other remote backup systems.

-For this tutorial you will need to use Rsync Target Server (Step 1) and Data Guard (Step 2+3) under Backup for this client/server backup feature. It also can be named for function "Remote Replication".

Step 1 – Enabling Rsync on your target (backup) NAS

-Log in to your target (backup) NAS through the UI in your web browser

-Go to Rsync Target Server under Backup in the menu of the UI



1. Enable Rsync Target Server
2. Add a username and password (they can be different than your NAS's username and password)
3. Select Apply

You will need this user name and password while the data is going to remotely backup to this Rsync target server.

Now Rsync is turned on your NAS, which means it can be used as a target for Rsync backup, in other words, only the backup NAS needs to be activated in this way.

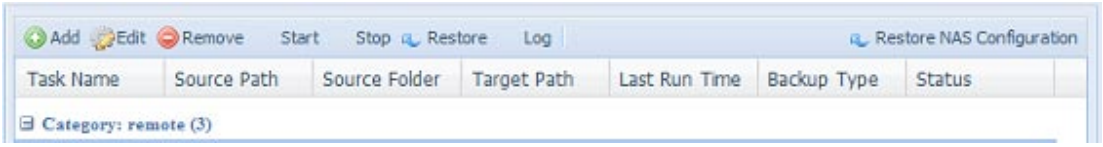
3.8.2 Data Guard (Remote Backup)

Step 2 – Setting up your backup task and schedule on your source NAS

-Log in to your other NAS (your source NAS) through the UI in your web browser

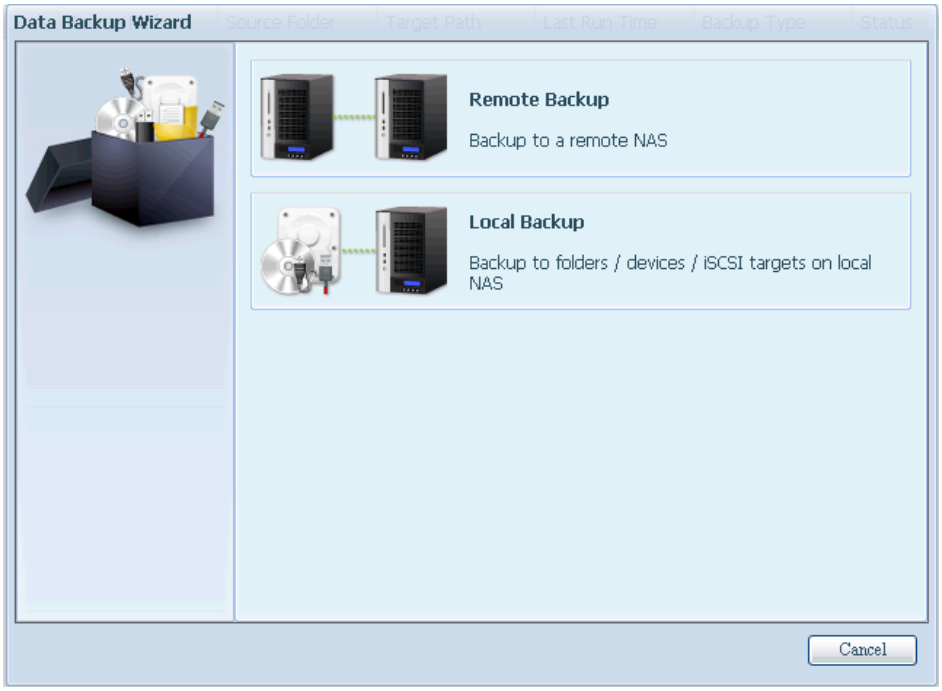
-Go to Data Guard under Backup in the System Management category of the UI

-From the Data Guard function list, choose Add

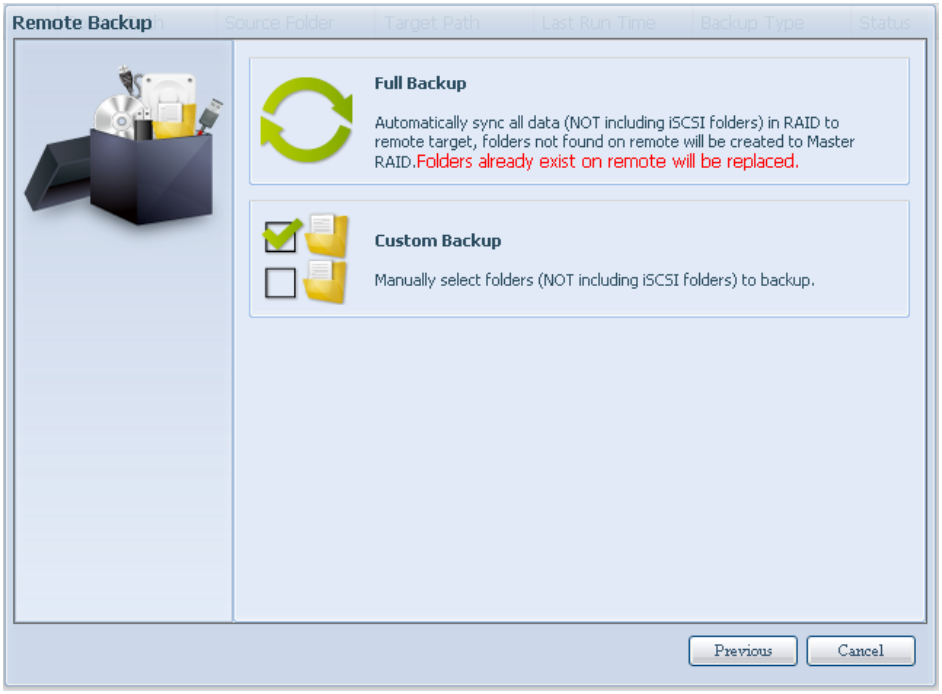


Remote Data backup	
Item	**Description**
Add	Add new task.
Edit	Edit select task.
Remove	Remove select task
Start	If associated task has been setup in schedule and like to start at once, click on to start task right away.
Stop	Stop the associated running task. The other scenario is if a task has been setup in real-time then clicking "Stop" can terminate the running process. Simple click 'Start" to re-start the real-time operation.
Restore	Restore the associated task
Log	Click to view the associated task in process details.
Restore NAS Configuration	Click to restore system configuration from selected destination to source unit. More details will describe in sections.

The data backup setup wizard appears as below, click on 'Remote Backup":



Then 2 different selections appear and can be chosen from:


Remote Backup
Source Folder
Target Path
Last Run Time
Backup Type
Status
Full Backup
Automatically sync all data (NOT including iSCSI folders) in RAID to remote target, folders not found on remote will be created to Master RAID.Folders already exist on remote will be replaced.
Custom Backup
Manually select folders (NOT including iSCSI folders) to backup.
Previous
Cancel

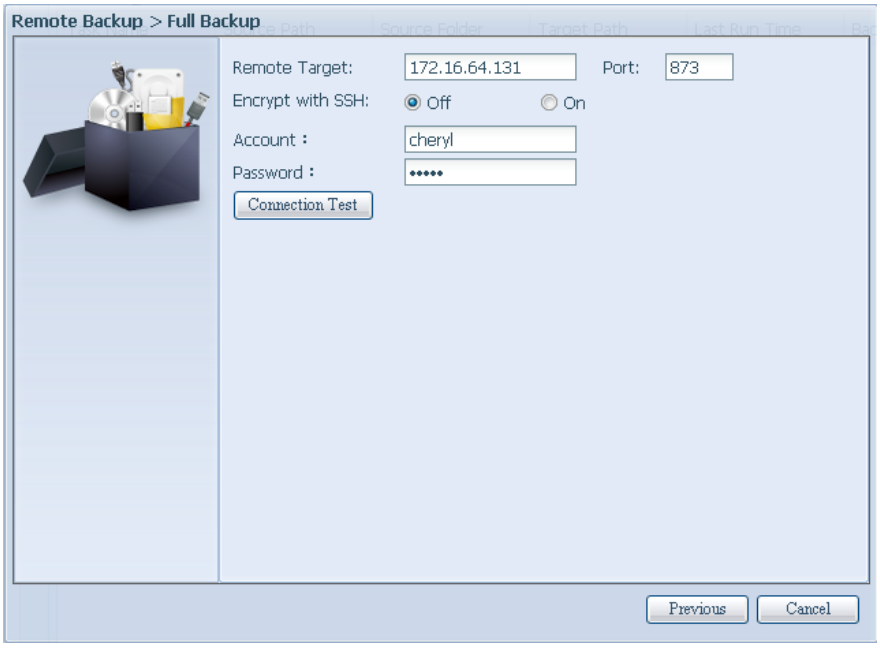
Remote Data backup	
Item	**Description**
Full Backup	The "Full backup" will have all shares from source backup to destination. It could also create shares automatically from destination if it is not existent. This only applies if the target server is the same model as the source.
Custom Backup	The "Custom backup" allows user to choose desired shares backup to destination.

- **Full Backup**

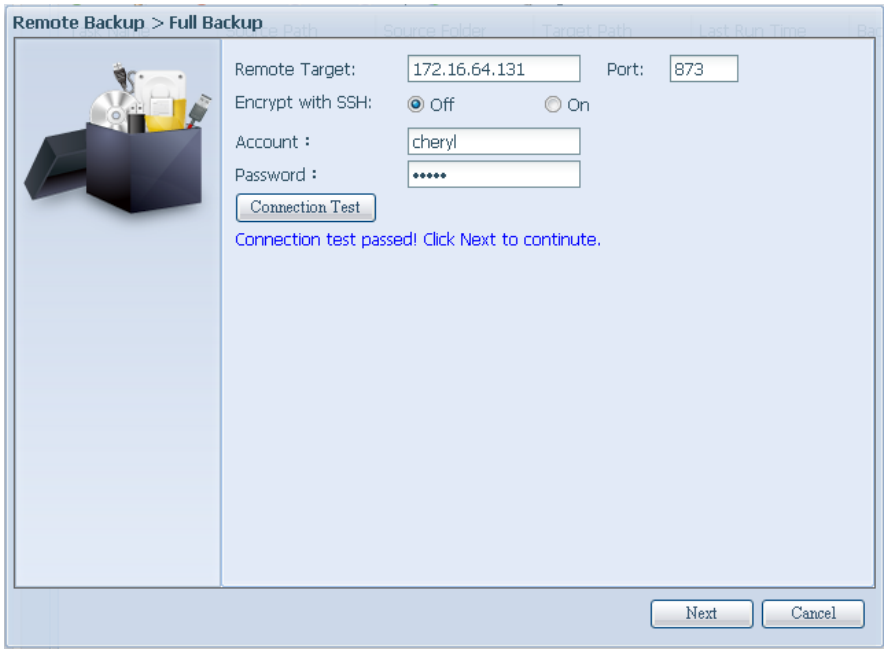
Click on full backup and the setup screen appear as below. Fill in the remote target IP (Destination) and port (need to be changed only if this port is already in use).

If encryption is required then enable it. Please make sure the associated target server also has encryption enabled.

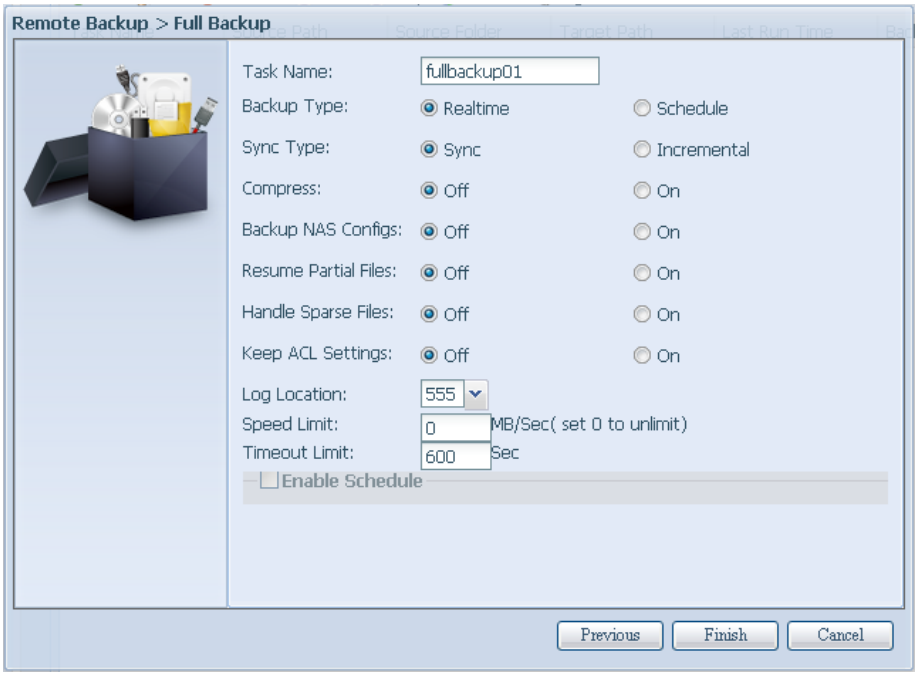
Carry on with inputting valid remote target server account name and password.



After the settings are complete, please click on "Connection Test". The source unit will try to connect with the associated target system. If a connection can be built up successfully then "Connection passed" will be prompted, otherwise "Failed" will appear.



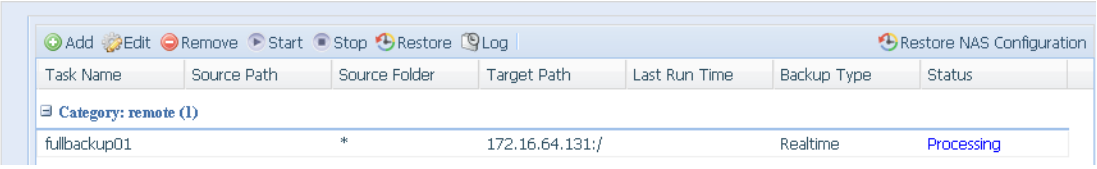
Click "Next" and more setting will appear.



-Fill out all the necessary details and choose your parameters

Add Rsync Backup Task	
Item	**Description**
Task Name	This is how this task will appear in the task list.
Backup Type	Real time: It will backup folders/files from source to target on the fly. On the other hand, any changes from the source will back up to the target right away. Schedule: The task will start only according to the schedule.
Sync Type	Sync mode: Makes your source match your target completely; deleting and adding files on your target as they are deleted and added on your source. Incremental Mode : Makes your source match your target and keep all old files; adding files on your target as they are added on your source, but NOT deleting files on your target as they are deleted on your source.
Compress	With this option, compress the file data as it is sent to the destination machine, which reduces the amount of data being transmitted – something that is useful over a slow connection.
Backup NAS Config	Enabling this will back up the source unit system configurations to the designed path on the target system.
Resume Partial File	
Handle Sparse File	Try to handle sparse file efficiently so they take up less space on the destination.
Keep ACL Setting	It will backup not just data itself but also ACL configuration with associated folders/files.
Log Location	Choose the folder to save the log details while the task is executed.
Speed Limit	Input the bandwidth control for data backup operation.
Timeout Limit	Setup the timeout when trying to build up a connection in between the source and the target system.
Enable Schedule	If backup is set as "Schedule", please input the related period and time.

After the required fields are filled and the parameters are setup, click 'Finish" to complete. The data guard task will appear in the list as shown below.

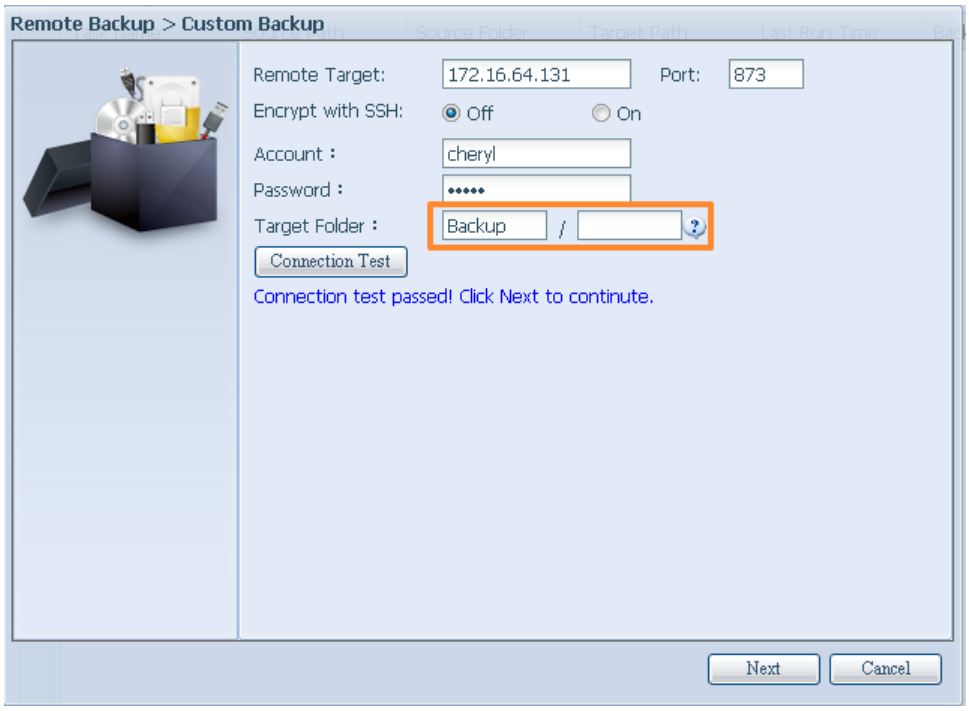


From the task list, you can now see the newly added task "fullback01". The backup is setup as "real time". From the status field, "Processing" can be read as the back-up is performed on the fly.

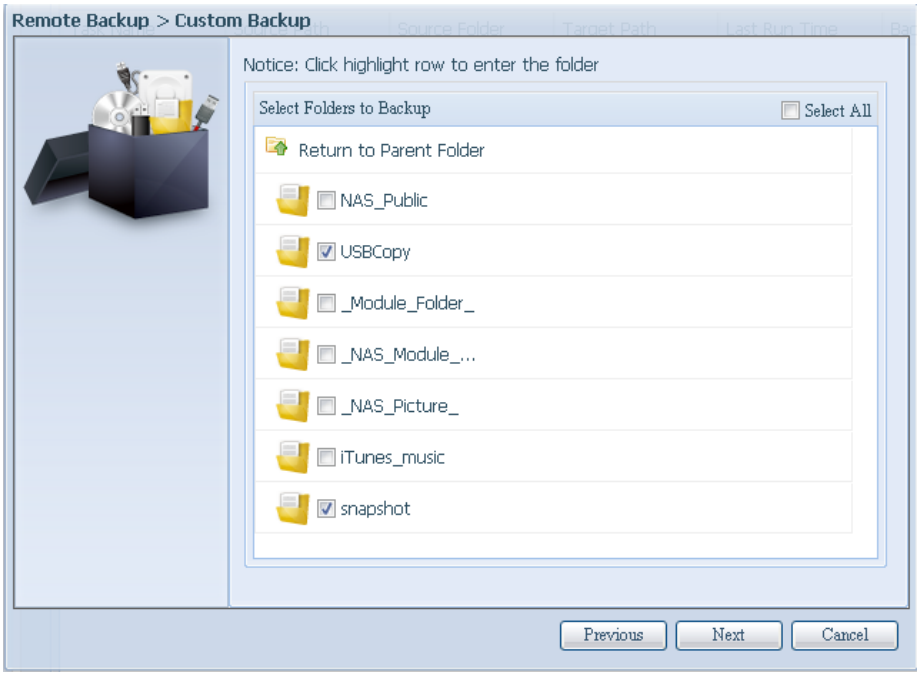
- **Custom Backup**

The custom backup setting is similar to the full backup. The only differences are explained below:

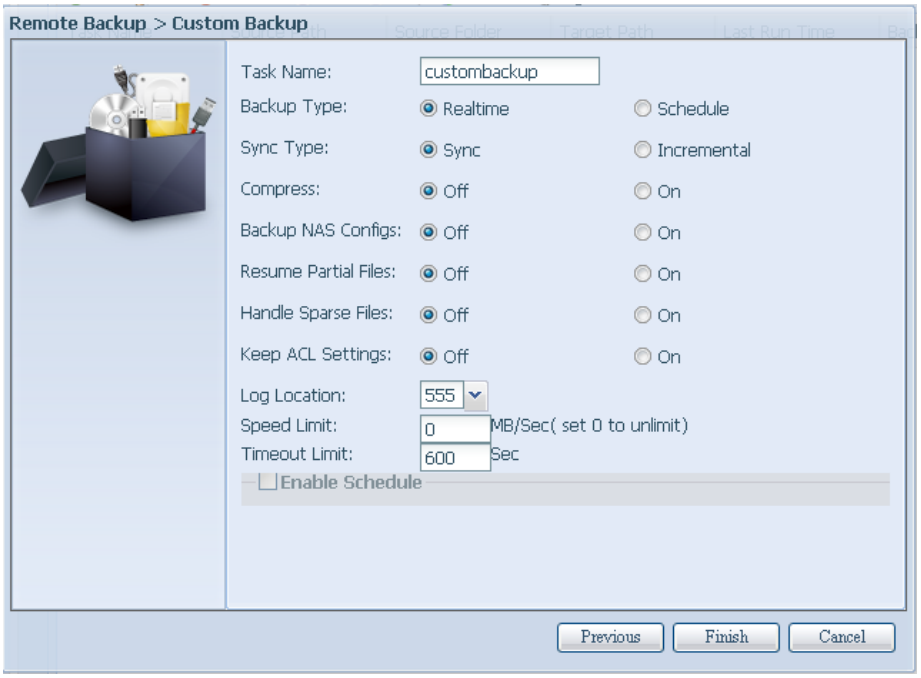
1. Inputs the share folder name of target sever where the source is going to backup. The sub-folder can be left as blank.



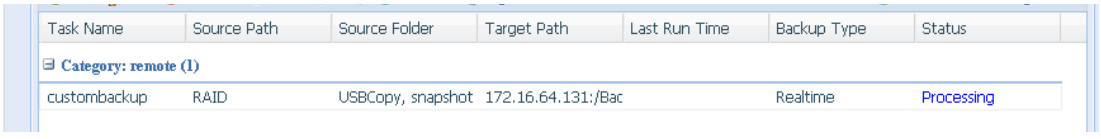
2. Select the source share folder(s) which are desired to be backed up to the target server. You can also click on "Select All" from top right corner check box.



3. Click "Next" and more setting appears. These are the as the settings for "Full backup"



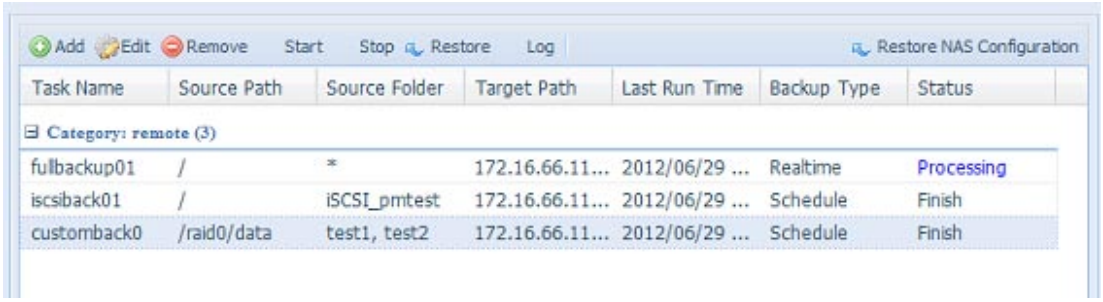
4. Click "Finish" and the data guard task will appear in the list as shown below.



From the task list, you can now see the newly added "customback01". This backup is setup as "schedule".

- **Restore**

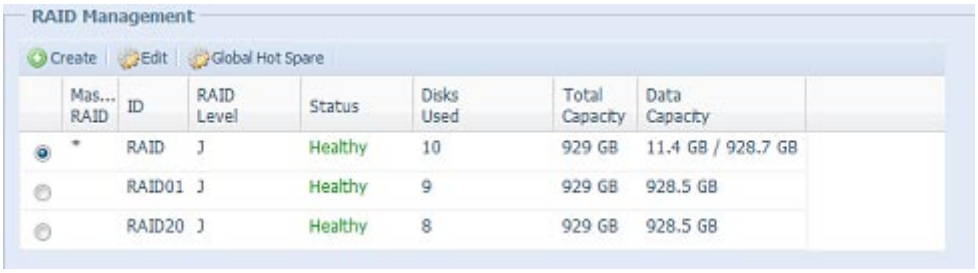
To restore a backup from the backup task, simply select a task from the task list then click "Restore" from the function bar. The restore task will start to have the associated files/folders from the target server restored to the source.



- **Restore NAS Configuration**

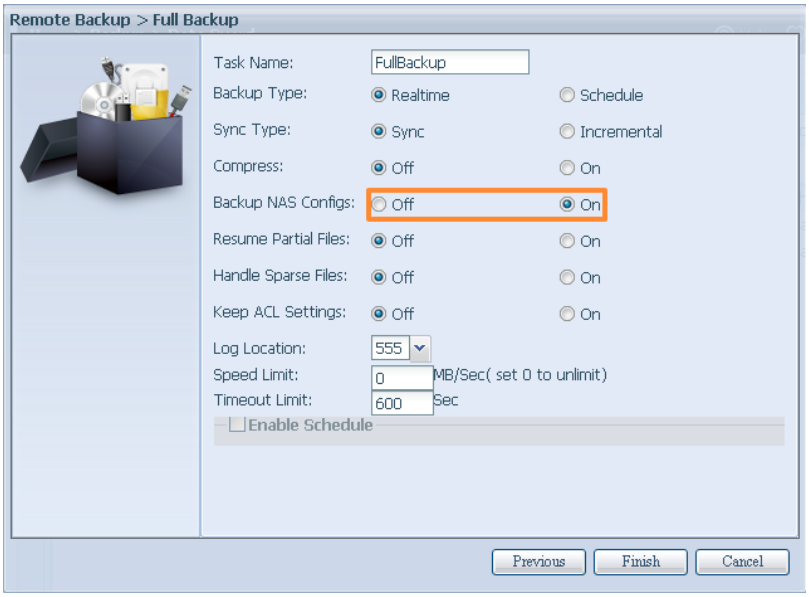
This is a useful feature if the system configuration needs to be restored to a brand new unit. Let's go thru the following example to see how it works.

The original source system has 3 RAID volume, "RAID", 'RAID10" and "RAID20", and has backed up the system configurations to the target server.

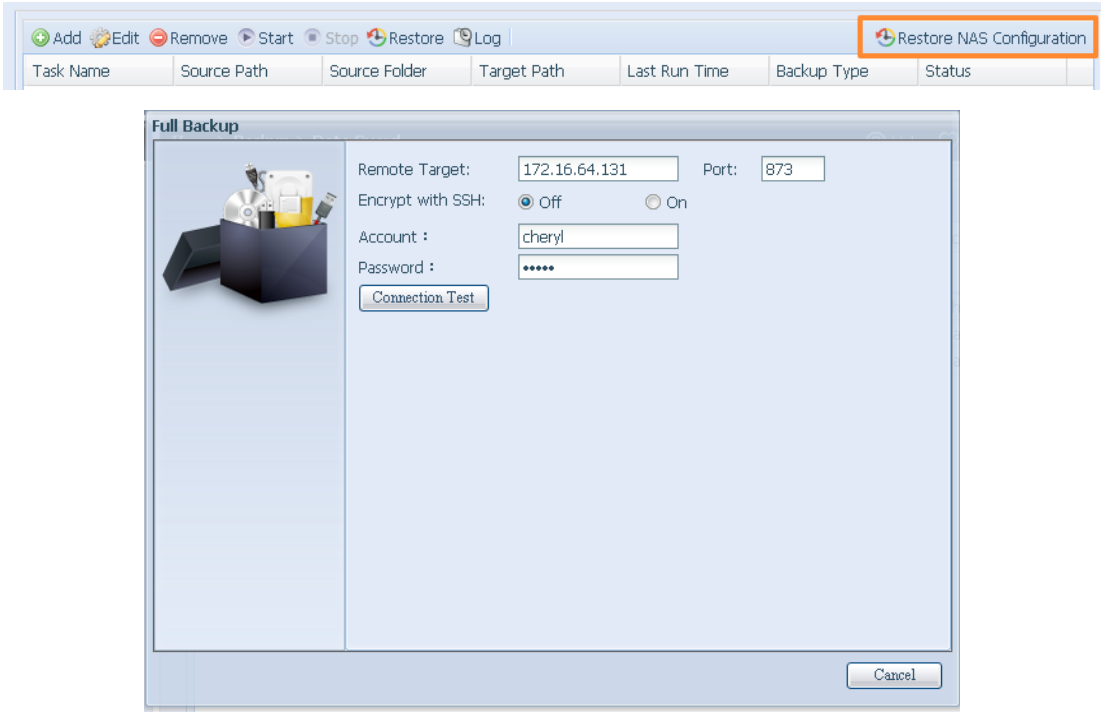


The brand new source unit only has a 1 RAID volume 'RAID".

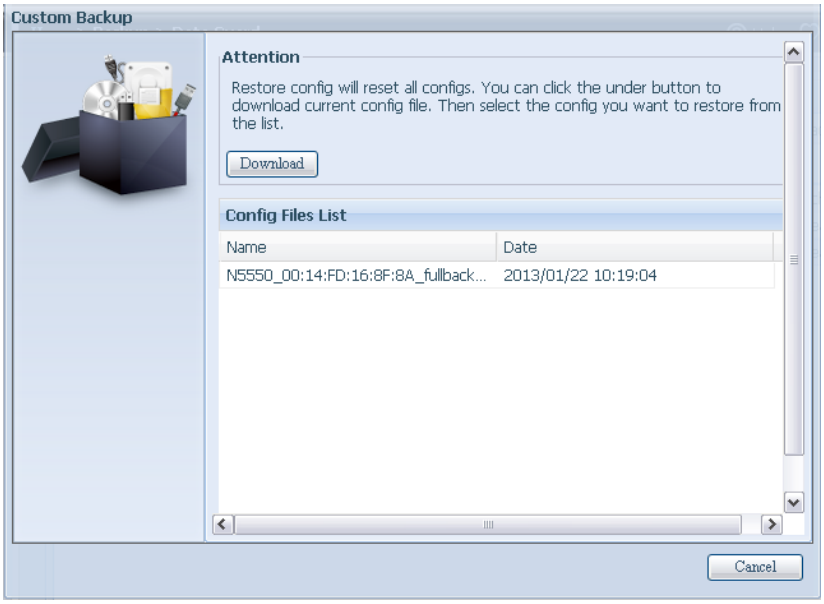
1. When adding a new backup task with "Full backup" or "Custom backup" and enabling the option "Backup NAS Config" as shows below, the source unit system configurations are then backed up to the designed path on the target system every time the task is executed.



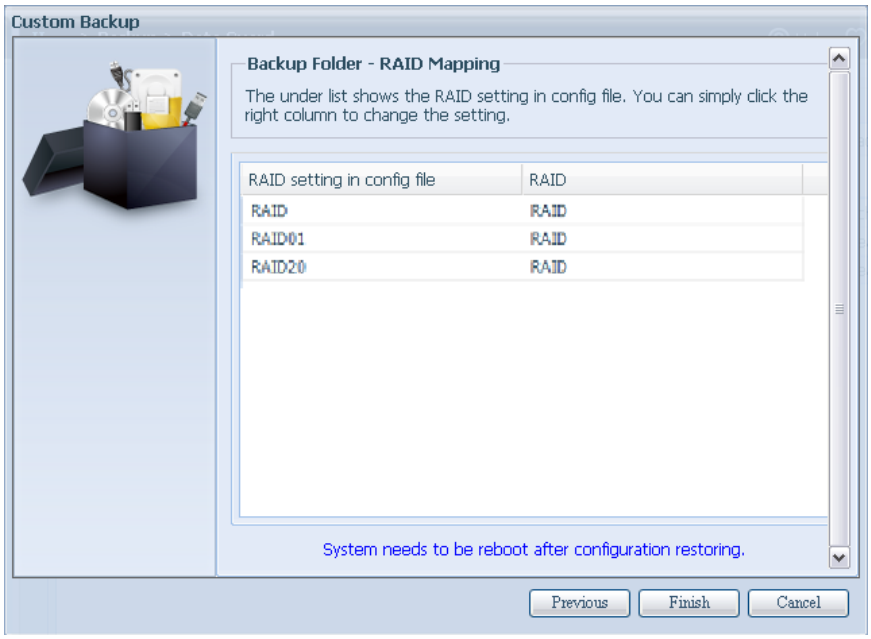
2. Click on "Restore NAS Configuration" and the screen shown below will appear. Input the target server's IP address where the system configuration has been backed up, and necessary authentication info. Confirm by doing a "Connection Test" to make sure the communication between the source and the target server works.



3. Click "Next" and a screen will appear as shown below. It has the listed available system configuration backup files. Select the one you want and click next. You also have the option to download the current system configuration before restoring from the backup file.


Custom Backup
Attention
Restore config will reset all configs. You can click the under button to download current config file. Then select the config you want to restore from the list.
Download
Config Files List
Name
Date
N5550_00:14:FD:16:8F:8A_fullback...
2013/01/22 10:19:04
Cancel

4. After clicking "Next", a screen will appear as shown below. Listed on the left hand side, you will see the configuration backup details which contain the 3 RAID volumes. On the right hand side, you will see a list of single "RAID" volume. You may roll back to previous page to recall the example we have taken.



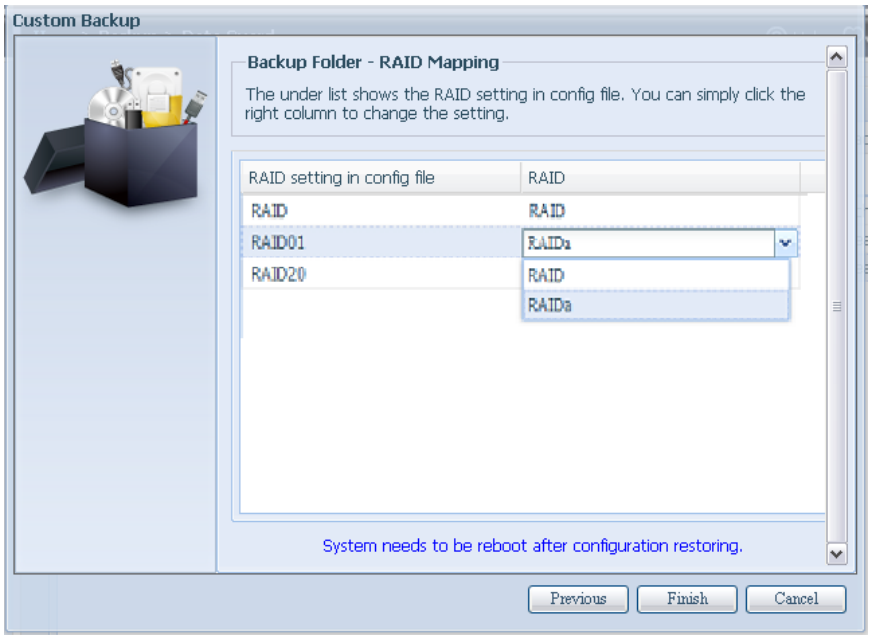
5. The backup configuration has different numbers of RAID volume than the current system (3 vs 1). It can be kept as the RAID volume mapping arranged by the system, then carry on to click "Finish". This means that all 3 RAID volumes configuration such as share folder etc. will all restore to the current unit in the RAID volume "RAID".

6. In other circumstances, if the current unit contains 2 RAID volumes, then it can be chosen from the left hand side of system backup configuration RAID volume list which RAID volume to map to the current system.

Let's see the following screen to make it clearer.

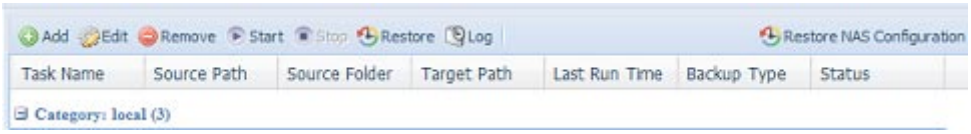
The current system has 2 RAID volumes, "RAID" and "RAIDa". Select the RAID volume from the backup configuration volume list which is going to be mapped to the RAID volume of the current system. Simply click on the right hand side of "RAIDa" and a drop down list will appear. Now you can choose which volume to map with. In this case the "RAID01" volume from the system backup configuration

will be mapped to the volume "RAIDa" of the current unit. Once again, it means all the shares that were created in the volume "RAID01" will be restored to volume "RAIDa" of the current system.



3.8.3 Data Guard (Local Backup)

The Thecus product provides complete backup solution between Thecus NAS systems as well as between folders of local systems.



Remote Data backup	
Item	**Description**
Add	Add a new task.
Edit	Edit selected task.
Remove	Remove selected task.
Start	Click on start to start a scheduled scan task right away.
Stop	Stop the associated running task. Also can be used if a task has been setup as real-time, clicking "Stop" can terminate the running process. Simply click 'Start" to re-start the real-time operation.
Restore	Restore the associated task.
Log	Click to view the associated task process details.
Restore NAS Configuration	Click to restore the system configurations from a selected destination to a source unit.

From the Data Guard function list, select Add. The data backup setup wizard appears as below, click on "Local Backup":

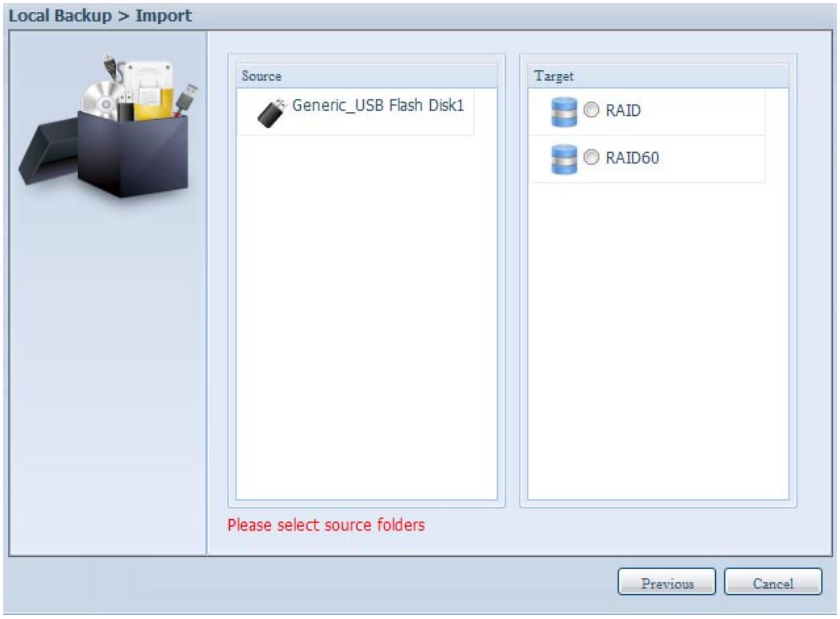
Data Backup Wizard
Remote Backup
Backup to a remote NAS
Local Backup
Backup to folders / devices / iSCSI targets on local NAS
Cancel

The local backup has 6 different selection you can choose from.

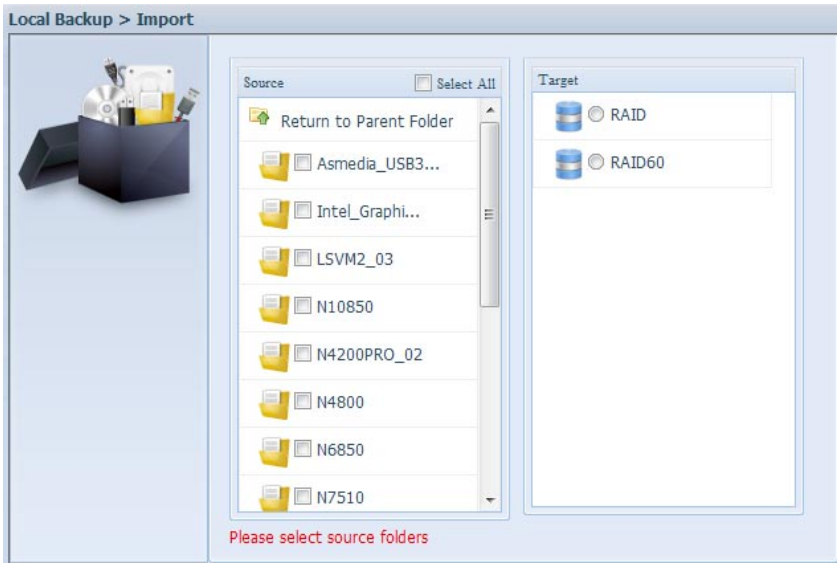
Local Backup
Import
External devices directly import to the NAS, and generate a new shared fol
Copy
Copy between folders according to the source and destination of your choi
Realtime Backup
Backup NAS Data Immediately
Schedule Backup
Backup NAS Data At Schedule Time
Previous
Cancel

Local Data backup	
Item	**Description**
Import	This is associated with external devices which are added to the system such as USB disk. You can select a folder from an external device and import it to the NAS as a share folder.
Copy	Copy folder to folder or NAS folder to external device or external device to NAS folder. This backup is within folder level.
Realtime Backup	The task will be executed on the fly between the source and the target. In other word, any changes made at the source will sync to the destination immediately.
Schedule Backup	The task will be executed on schedule between the source and the target.

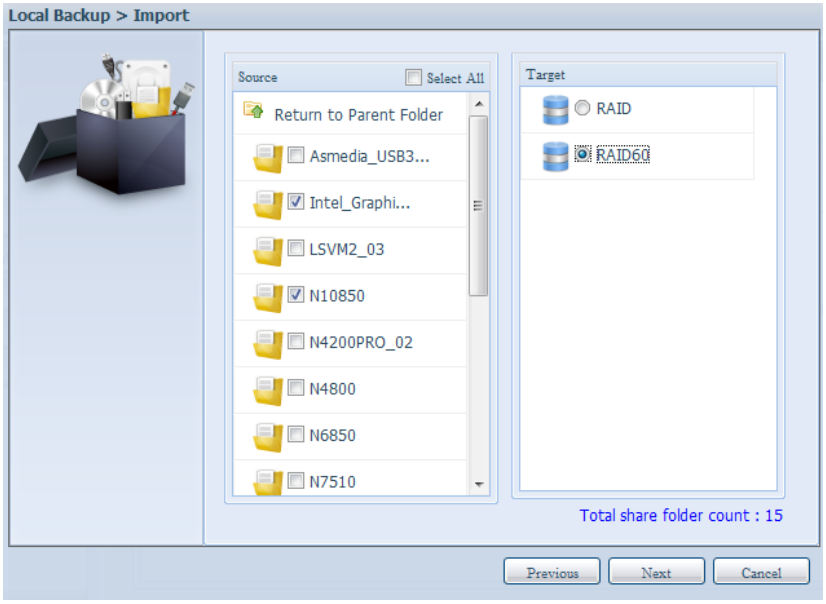
1. Import: click on "Import" and a screen will appear as below.
   If there is an external device installed on system such as USB disk, then it will be listed in the Source pane.



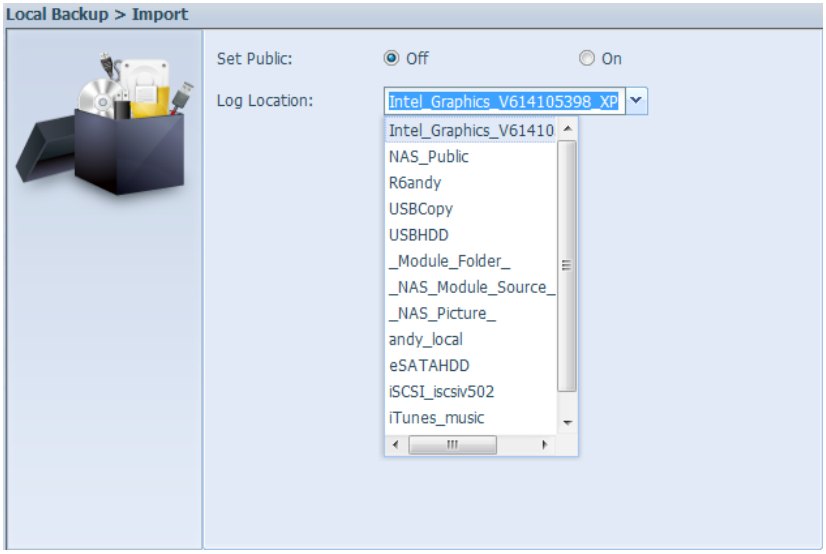
Click on the associated external device and the contain folders will be listed. Select the folders that are going to be imported to the NAS and select the available RAID volume which is listed in Target pane.



In here, we have selected the "Intel Graphi…" and "N10850" folders from the external device and imported them to the NAS under the RAID60volume.

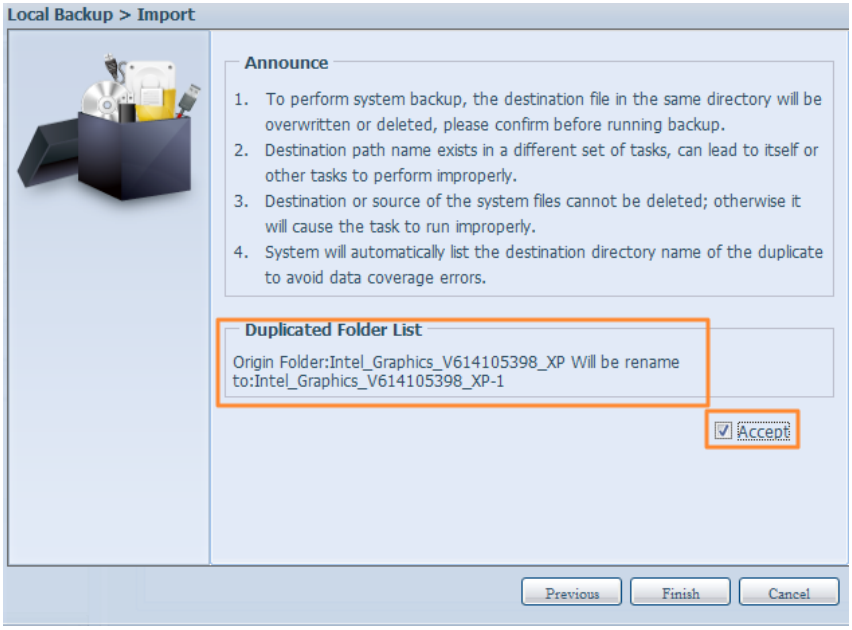


Next, please select the path from the drop down list to save the log. Also, give the access permission whether these selected folders will be "Public" or not after the import.

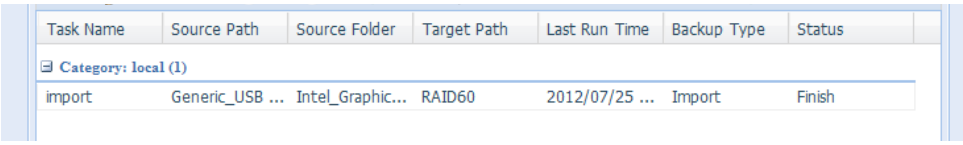


Read the notes and check the "Accept" box for confirmation. If a share name already exists for the import, then the import will be rename automatically to "existing share name -1".

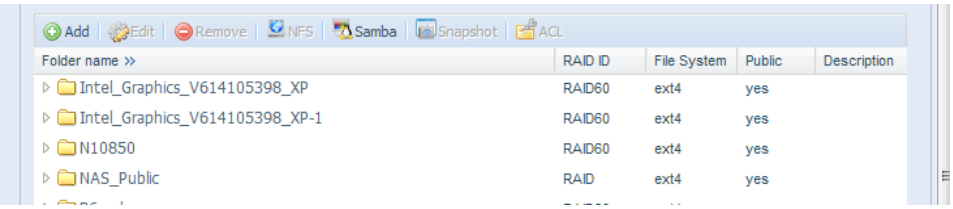
For esample, if the NAS RAID volume "RAID60" already has a folder named "Intel_Graphics_V614105398_XP", the import folder will then be rename to: "Intel_Graphics_V614105398_XP-1".


Local Backup > Import
Announce
1. To perform system backup, the destination file in the same directory will be overwritten or deleted, please confirm before running backup.
2. Destination path name exists in a different set of tasks, can lead to itself or other tasks to perform improperly.
3. Destination or source of the system files cannot be deleted; otherwise it will cause the task to run improperly.
4. System will automatically list the destination directory name of the duplicate to avoid data coverage errors.
Duplicated Folder List
Origin Folder:Intel_Graphics_V614105398_XP Will be rename to:Intel_Graphics_V614105398_XP-1
Accept
Previous
Finish
Cancel

Now, you will see in the data guard task list that you have created a task .



And that the system has created 2 new share folders from the task just created.

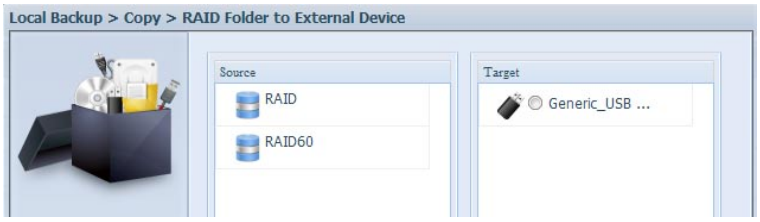


2. Copy: click on "Copy" and this screen appears.
   3 different options can be selected, folder to folder, folder to external device or external device to folder.

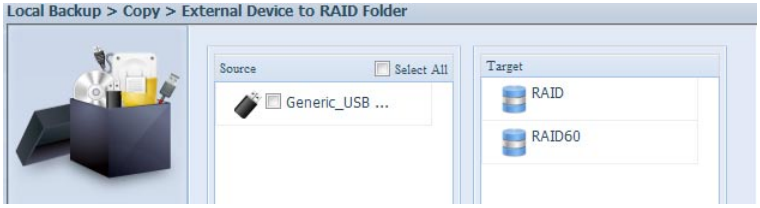
Local Backup > Copy
RAID Folder -> RAID Folder
To select more than one folder to copy to a single destination fold
RAID Folder -> External Device
To select more than one folder to copy to a single external device
External Device -> RAID Folder
Choose external device to copy to a single folder
Previous
Cancel

- **Folder to Folder**

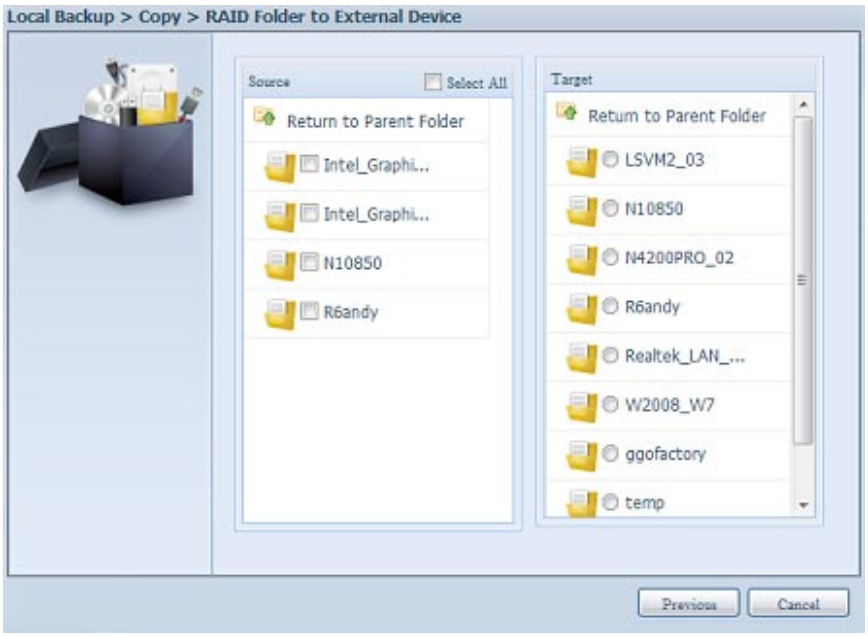
- **Folder to external device**



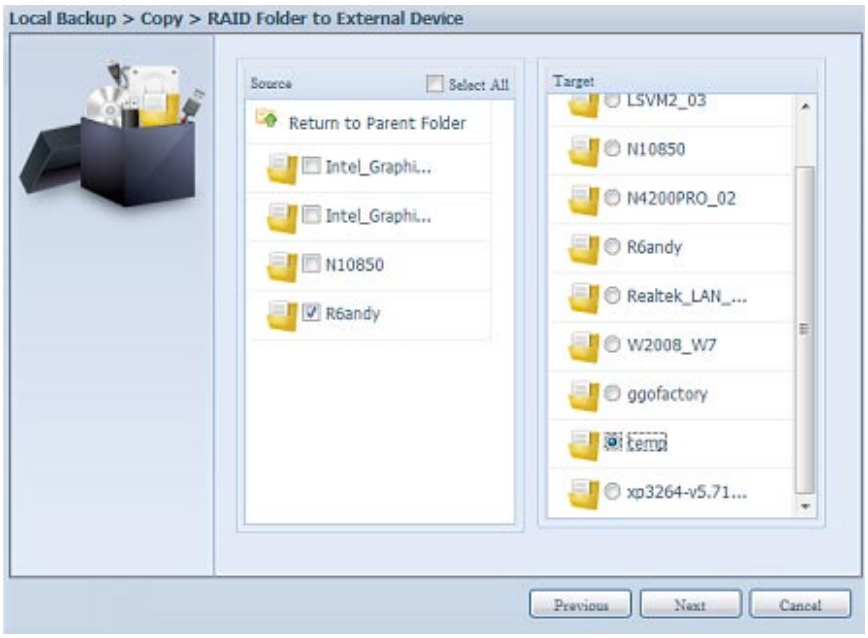
- **External device to Folder**



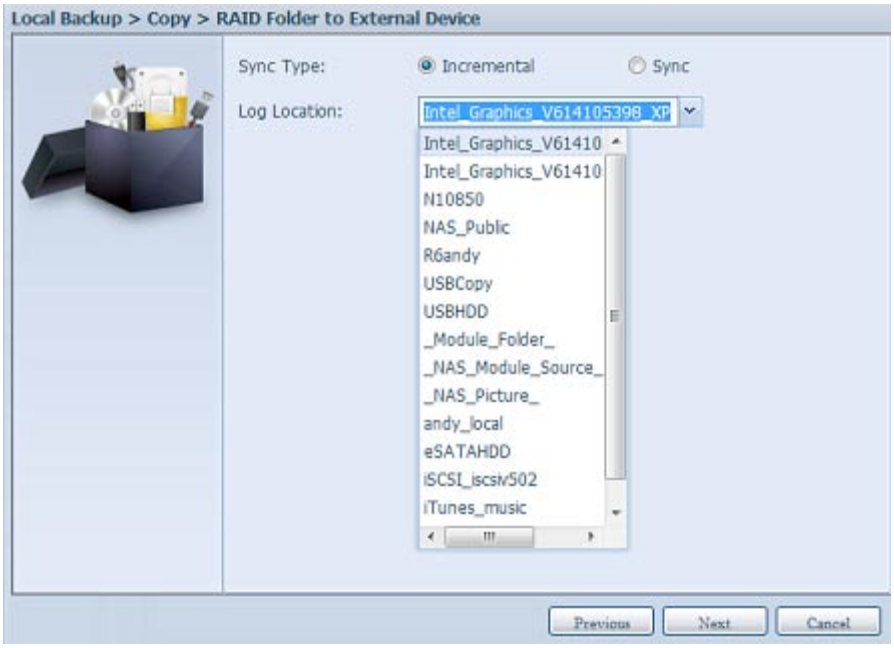
Let's take "Folder to External device" as an example. In the source pane, select the desired RAID volume and its associated folder list will appear; same method in the target pane for the associated external device.



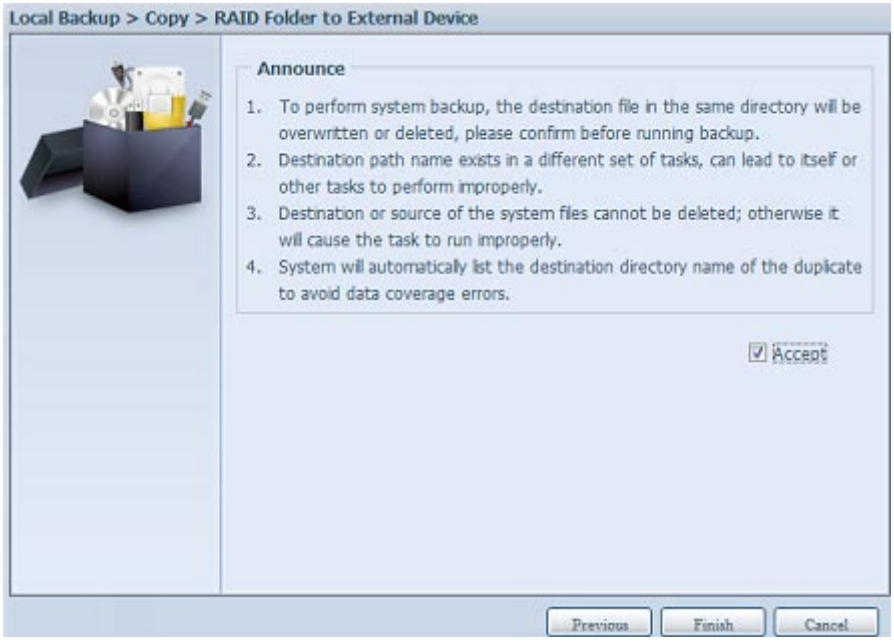
Select a folder from the source pane which is going to be copy over, then select in target pane it's destination.



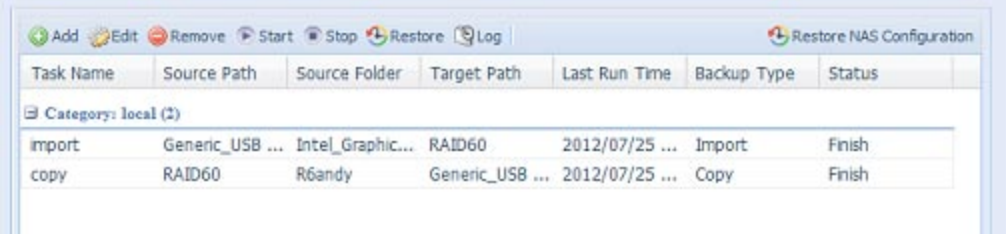
Choosing the sync type, "Incremental" or 'Sync", and select the log path from the drop menu list.



Read the notes and check the "Accept" box for confirmation.

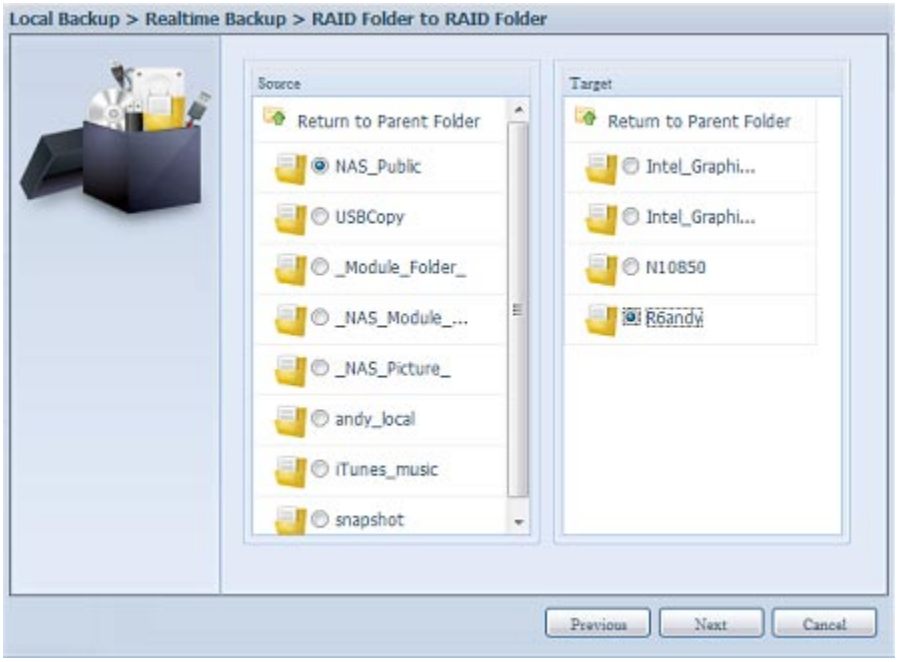

Local Backup > Copy > RAID Folder to External Device
Announce
1. To perform system backup, the destination file in the same directory will be overwritten or deleted, please confirm before running backup.
2. Destination path name exists in a different set of tasks, can lead to itself or other tasks to perform improperly.
3. Destination or source of the system files cannot be deleted; otherwise it will cause the task to run improperly.
4. System will automatically list the destination directory name of the duplicate to avoid data coverage errors.
Accept
Previous
Finish
Cancel

Now, you will see in the data guard task list that you have created a task.

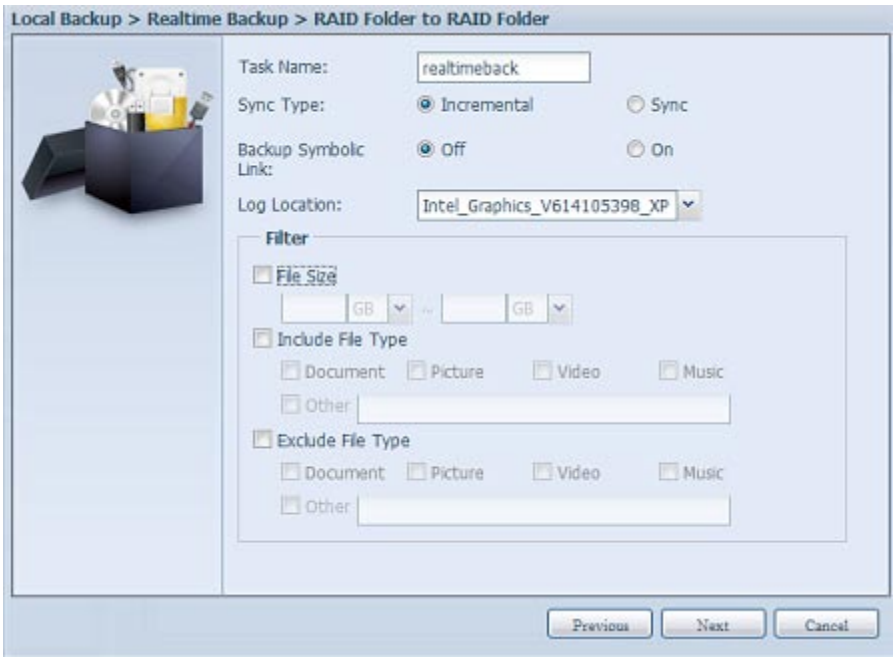


3. Realtime Backup: click on "Realtime Backup" and this screen will appear.
   2 different options can be selected from, folder to folder, folder to external device.

   Let's take "Folder to Folder" backup for example. Select from the source pane the folder "NAS_Public", then select its destination in the target panefolder "R6andy".

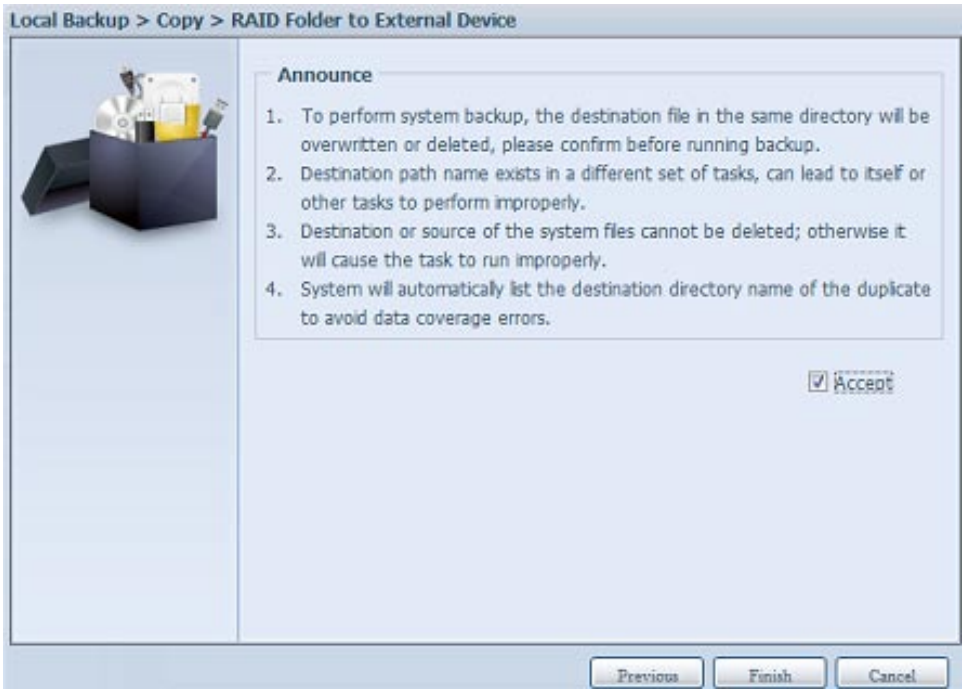


Next, fill in the task name and related settings.

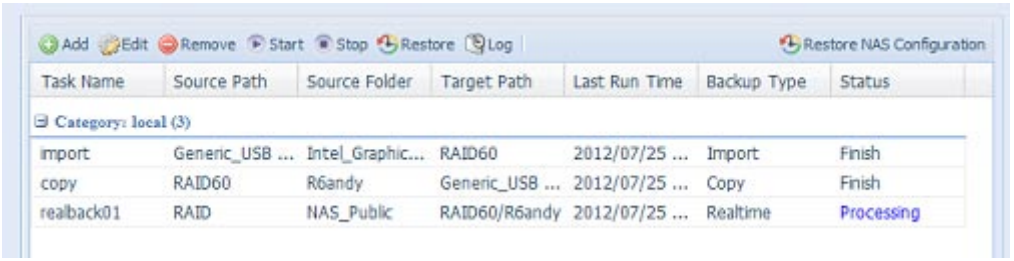


Realtime Backup	
Item	**Description**
Task Name	Input the task name, length limited to 4~12 characters.
Sync Type	Select "Incremental" or "Synchronize".
Backup Symbolic Link	Choose to backup symbolic link which is included in the source.
Filter	The filter can be set to be executed only in certain circumstances. If none of them has been selected, it will do the real time backup from the source to the destination in full. File size: From xx ~ xxx If xx=1 and xxx blank then only file size > xx will execute real time backup. If xx=1 and xxx=2 then only size in between xx and xxx will execute real time backup. If xx blank and xxx=2 then only file size < xxx will execute real time backup. Include File Type: Only the associated file format will do the real time backup. Exclude File Type: The excluded file format won't be included in the real time backup. For document file format: doc, xls, pdf, docx, xlsx, txt, ppt, pptx, html, htm For picture file format: jpg, bmp, tif, png, pbm, tga, xar, xbm For video file format: avi, mpg, mp4, mkv, fli, flv, rm, ram For music file format: mp3, wav, wma, acc, dss, msv, dvf, m4p, 3gp, amr, awb User defined can be input in other box.

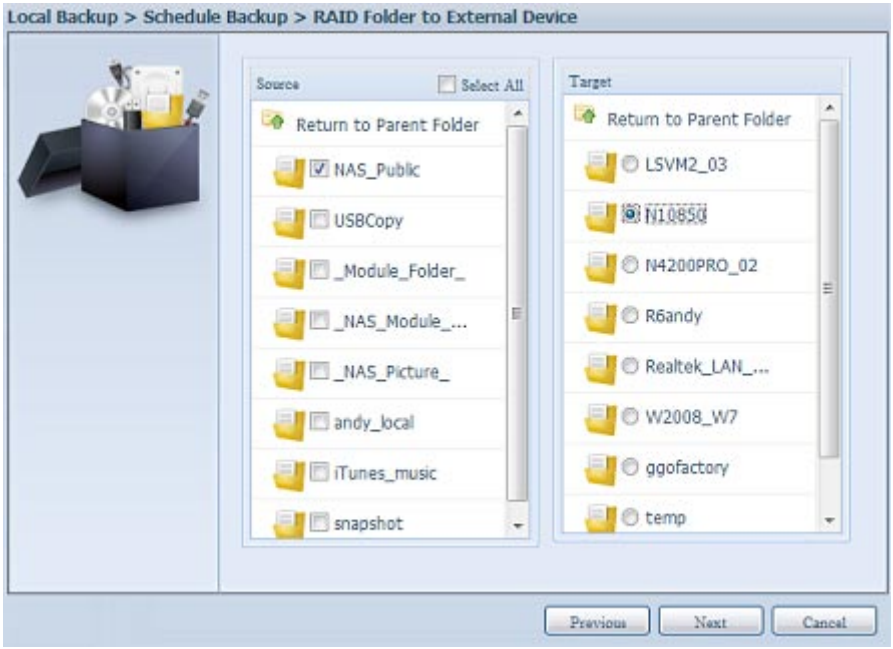
Read the notes and check the "Accept" box for confirmation.


Local Backup > Copy > RAID Folder to External Device
Announce
1. To perform system backup, the destination file in the same directory will be overwritten or deleted, please confirm before running backup.
2. Destination path name exists in a different set of tasks, can lead to itself or other tasks to perform improperly.
3. Destination or source of the system files cannot be deleted; otherwise it will cause the task to run improperly.
4. System will automatically list the destination directory name of the duplicate to avoid data coverage errors.
Accept
Previous
Finish
Cancel

Now, you can see in the data guard task list that your created task is listed. The task status will say "Processing" untill the "Stop" button is pressed.

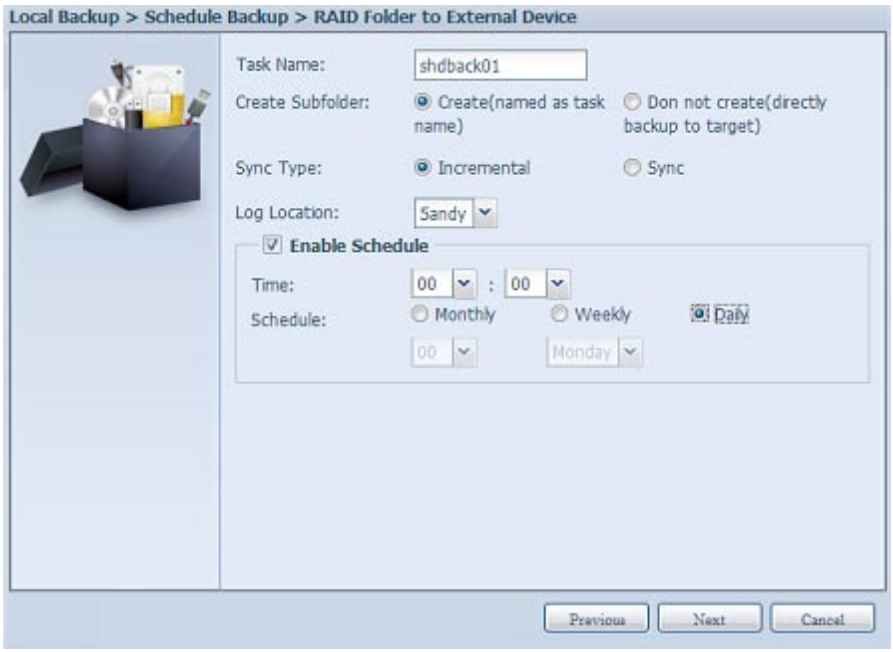


4. Schedule Backup: click on "Schedule Backup" and this screen will. 2 different choices can be selected from, folder to folder, folder to external device.
   Let's use "Folder to External device" backup for our example. From the NAS volume RAID in the Source pane select the folder "NAS_Public", then in the target pane select the external USB disk folder "N10850".

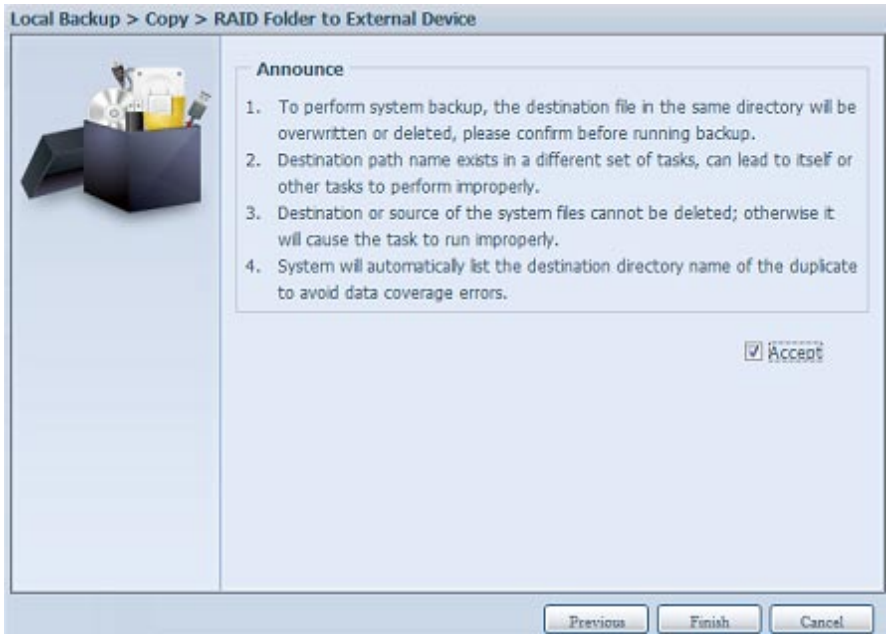


Next, fill in the task name and related settings.

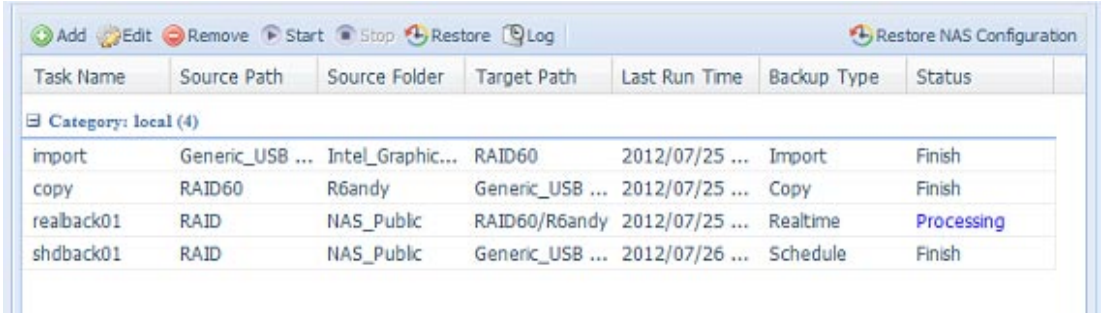
Schedule Backup	
Item	Description
Task Name	Input the task name, length limited to 4~12 characters.
Create Sub-folder	If you choose to create a sub-folder, then it will use the task name as folder name then copy the source under it. Or it will copy the source to the same level as the destination.
Sync Type	Select "Incremental" or "Synchronize".
Log Location	Select from the drop down list where the task log will be stored.
Enable Schedule	Click to enable. If it is not checked, the task won't start unless you select the associate task and click "Start" from the task list page.
Time	Specify the time for the backup to start.
Schedule	Can choose daily, weekly or monthly.



Read the notes and check the "Accept" box for confirmation.


Local Backup > Copy > RAID Folder to External Device
Announce
1. To perform system backup, the destination file in the same directory will be overwritten or deleted, please confirm before running backup.
2. Destination path name exists in a different set of tasks, can lead to itself or other tasks to perform improperly.
3. Destination or source of the system files cannot be deleted; otherwise it will cause the task to run improperly.
4. System will automatically list the destination directory name of the duplicate to avoid data coverage errors.
Accept
Previous
Finish
Cancel

Now, you will see in the data guard task list that you have created a task.



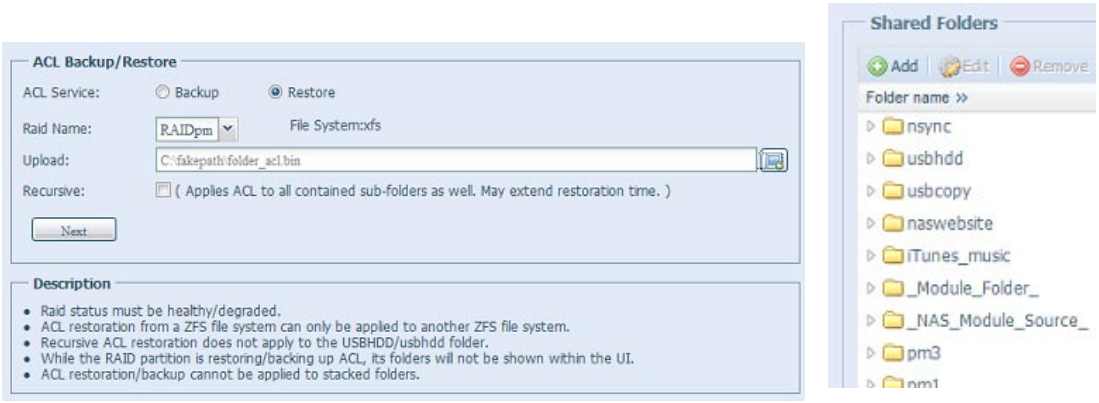
3.8.4 ACL Backup and Restore

The ACL backup and restore feature enables the system ACL (Access Control List) to be backed up on the RAID volume based to other location and restored if needed.

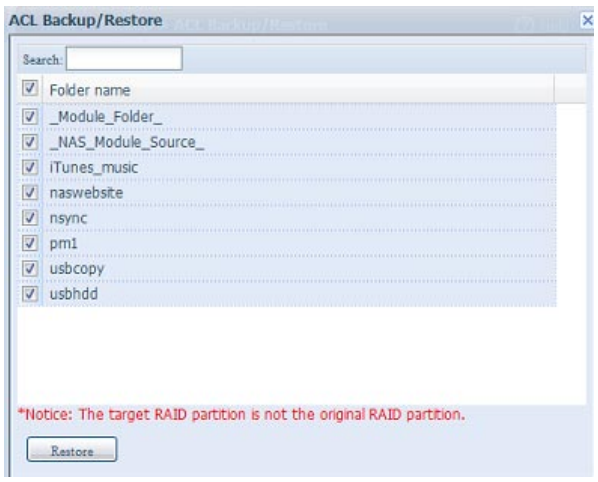
Let's look at the example bellow to see how it works.

We have one system with a RAID volume "RAID", select "Backup" to backup this RAID volume's ACL to other location. The current RAID volume "RAID" has share folder as listed on right hand screen shot.

For the ACL restore, it can be restored in the same system or used in another unit. For example, let's restore the ACL backup file to another unit. This unit has a RAID volume "RAIDpm" with share folders as listed on right hand screen shot.



After inputting the ACL backup file and clicking the "Next" button, the system will show another screen to list the matched folders in between the backup file and this RAID volume. Just select the desired folders for the ACL restore.

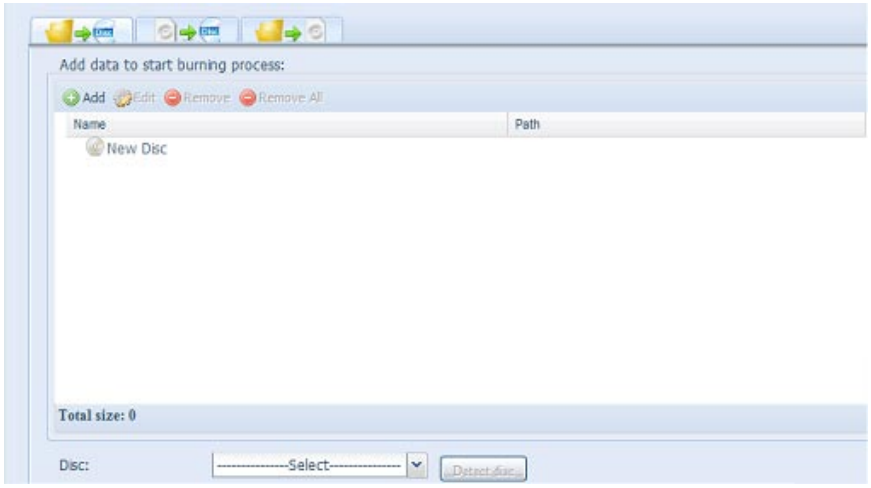


- The ACL backup will only back to share folder level; it does not apply to its sub-layer.
- If recursive has been checked during the ACL restoration, it will apply to all of its sub-folders with the same permission.

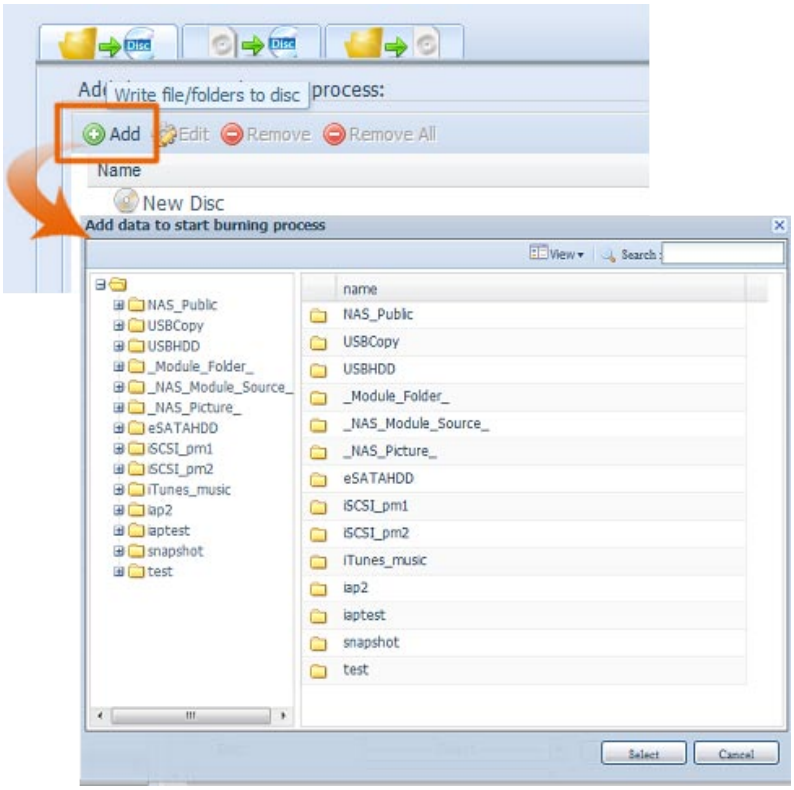
3.8.5 Data Burn

The data burn is featured to support 3 different modes of data burning for files/folders to and from image file and physical optical disk.

The 3 different modes are "Write Files/folders to disc", "Write image to disk" and "Write files/folders to image".

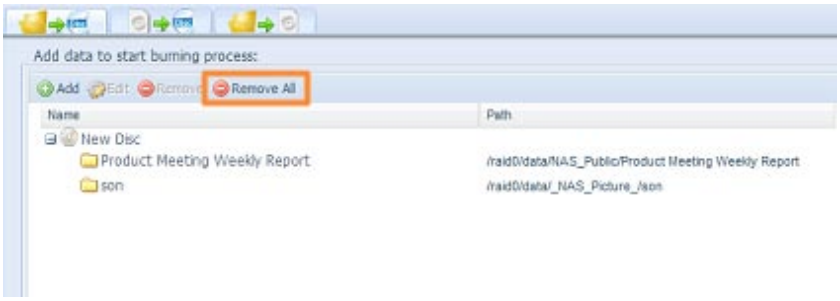


1. Write Files/folders to disc



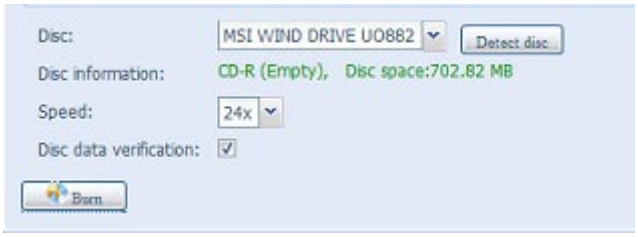
a. Click the Add button and the NAS share list appears.

b. Select files/folders which you would like to burn. All of the selected folders/files will be seen under the disc label name "New Disc". The disc label name can be changed by clicking on it and press "Edit" from menu bar. The selected folders/files also can be removed by clicking on them and then pressing "remove" or "remove all" for all selected items.



c. Select from the installed USB burning devices. Please click the "detect disc" button to check the status once the disc is inserted.

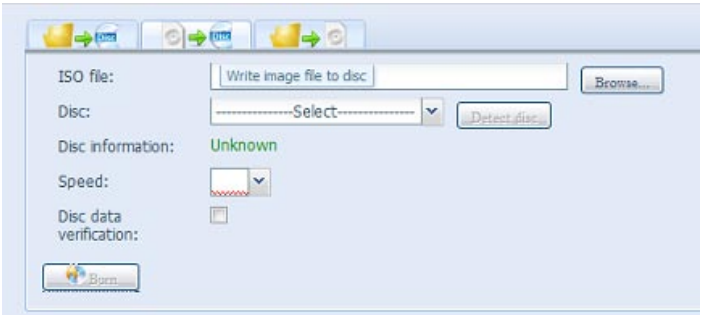
d. Select the burning speed from the drop down list.



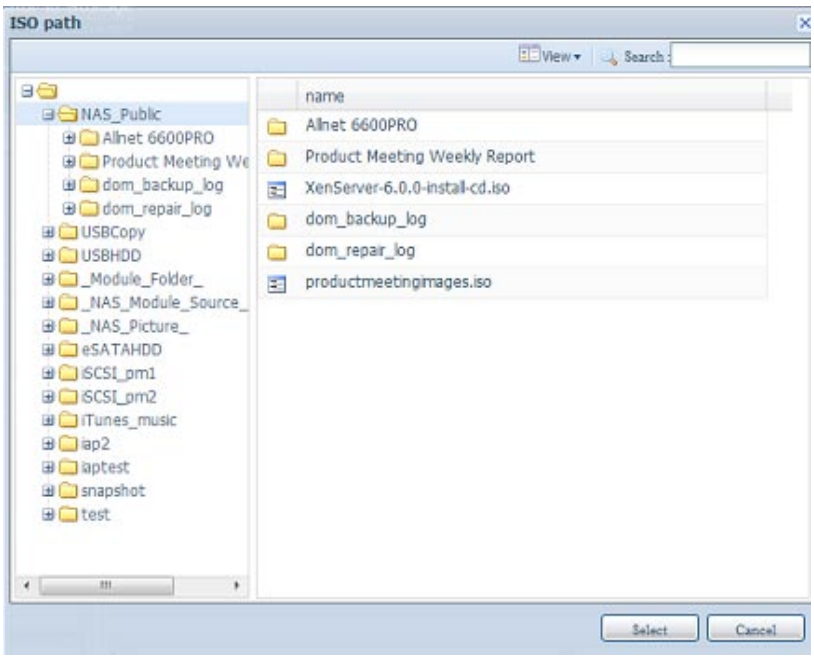
e. Select whether disc data verification is required or not.

f. Click "Burn" to start disc burning.

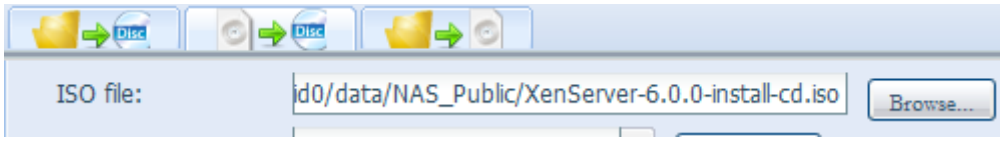
2. Write image file to disc.



a. Click "Browser" and the NAS share list will appear to locate the desired image file to burn.



b. Select the ISO file.



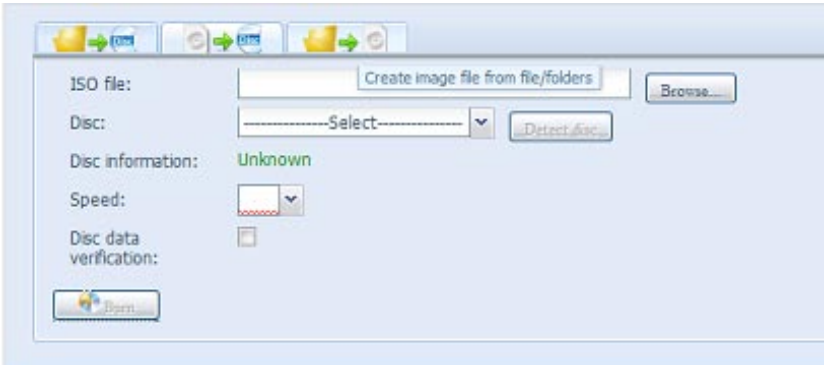
c. Select from the installed USB burning devices. Please click the "detect disc" button to check the status once the disc is inserted.

d. Select the burning speed from the drop down list.

e. Select whether disc data verification is required or not.

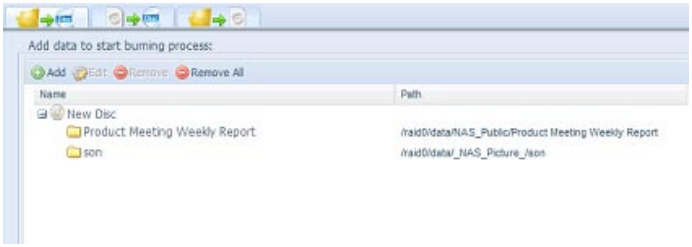
f. Click "Burn" to start disc burning.

3. Create image file from files/folders



a. Click the Add button and the NAS share list will appear.

b. Select the files/folders which you would like to burn. All of the selected folders/files will appear under the disc label name "New Disc". The disc label name can be changed by clicking on it and pressing "Edit" from the menu bar. The selected folders/files also can be removed by clicking on them and pressing "remove" or "remove all" for all the selected items.



c. Input the path where the ISO file is going to be stored, you can press the "Browse" button to have the share list appear.

d. Input the ISO file name for burned image file.

e. Click "Burn" to start the ISO file burning.

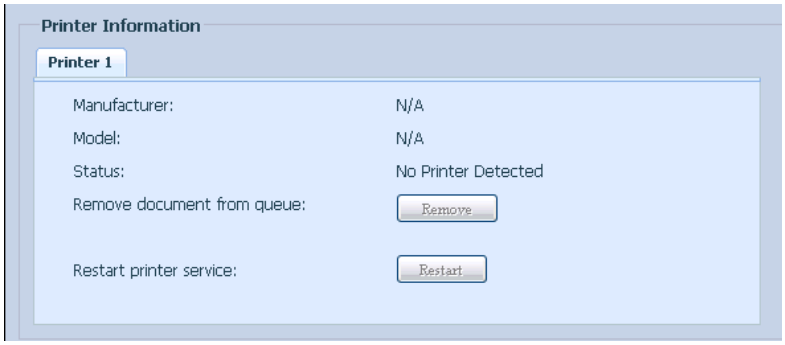
The data burn does not support rewriteable media if it has been burned with left space. On the other hand, the used rewriteable media will be erased first then carry on with burning.

3.9 External Devices

The Thecus IP storage supports printer server and UPS via USB interface. The integrated Print Server allows you to share a single USB printer with all users on the network. For the UPS, Thecus IP storage support via USB, Series and Network interface. The following section shows you how.

3.9.1 Printers

From the External Devices menu, choose the Printer item, and the Printer Information screen appears. This screen provides the following information about the USB printer connected to the USB port.



Printer Information	
Item	**Description**
Manufacturer	Displays the name of the USB printer manufacturer.
Model	Displays the model of the USB printer.
Status	Displays the status of the USB printer.
Remove document from Queue	Click to remove all documents from printer queue
Restart Printer service	Click to restart printer service

If a corrupt print job is sent to a printer, printing may suddenly fail. If your print jobs seem to be locked up, pressing the Remove All Documents button to clear the print queue may resolve the issue.

You can configure Thecus IP storage to act as a printer server. That way, all PCs connected to the network can utilize the same printer.

- **Windows XP SP2**

To set up the Printer Server in Windows XP SP2, follow the steps below:

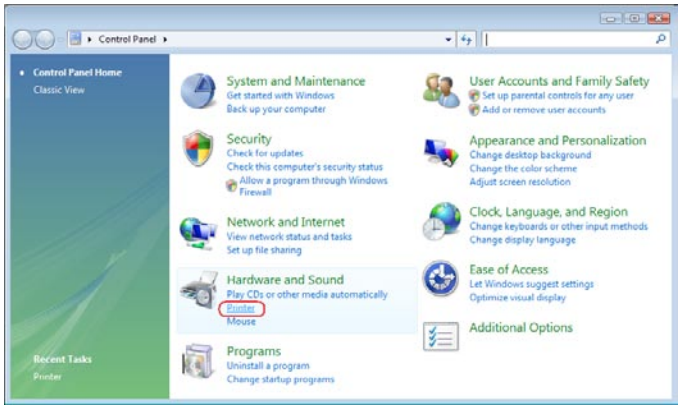
1. Connect the USB printer to one of the USB ports (preferably the rear USB ports; front USB ports can be used for external HDD enclosures).
2. Go to Start > Printers and Faxes.
3. Click on File > Add Printer.
4. The Add Printer Wizard appears on your screen. Click Next.
5. Select the "A network printer, or a printer attached to another computer" option.
6. Select "Connect to a printer on the Internet or on a home or office network", and enter "http://Thecus IP storage IP_ADDRESS:631/printers/usb-printer" into the URL field.
7. Your Windows system will ask you to install drivers for your printer. Select the correct driver for your printer.
8. Your Windows system will ask you if you want to set this printer as "Default Printer". Select Yes and all your print jobs will be submitted to this printer by default. Click Next.
9. Click Finish.

Note that if a multi-function (all-in-one) printer is attached to the Thecus IP Storage, usually only the printing and fax functions will work. Other features, such as scanning, will probably not function.

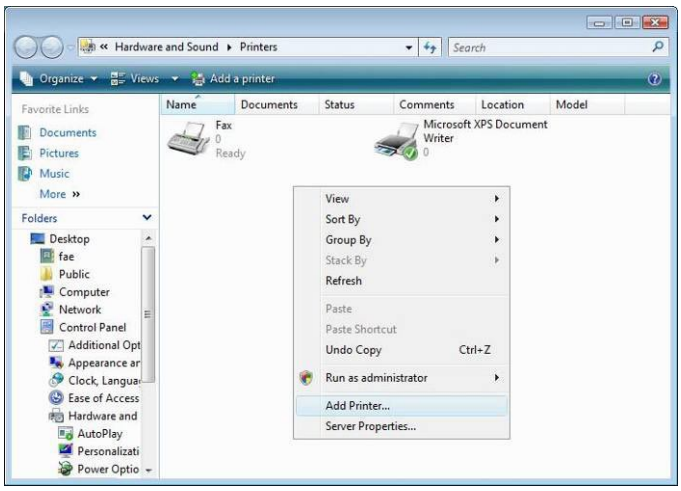
- **Windows Vista**

To set up the Printer Server in Windows Vista, follow the steps below:

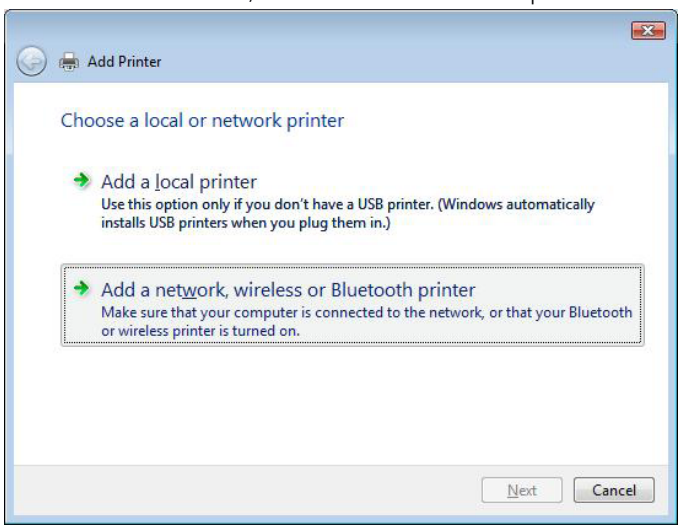
1. Open Printer Folder from the Control Panel.



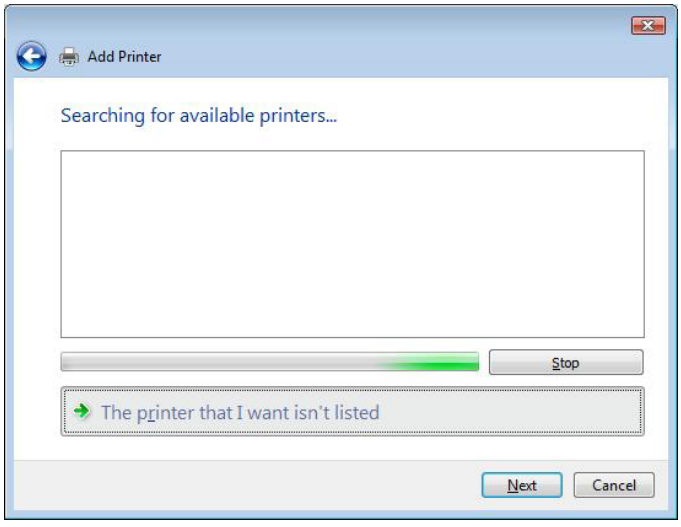
2. Click the right mouse button in anywhere on the Printers folder and then select Add Printer.



3. Select Add a network, wireless or Bluetooth printer.

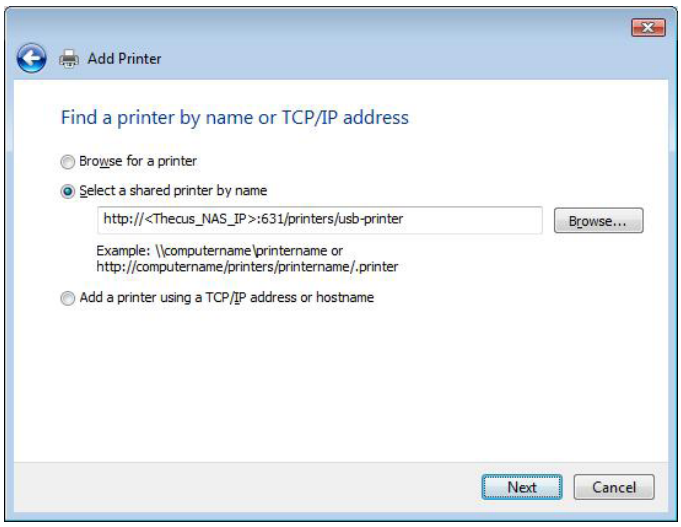

Add Printer
Choose a local or network printer
Add a local printer
Use this option only if you don't have a USB printer. (Windows automatically installs USB printers when you plug them in.)
Add a network, wireless or Bluetooth printer
Make sure that your computer is connected to the network, or that your Bluetooth or wireless printer is turned on.
Next
Cancel

4. Select The printer that I want isn't listed.



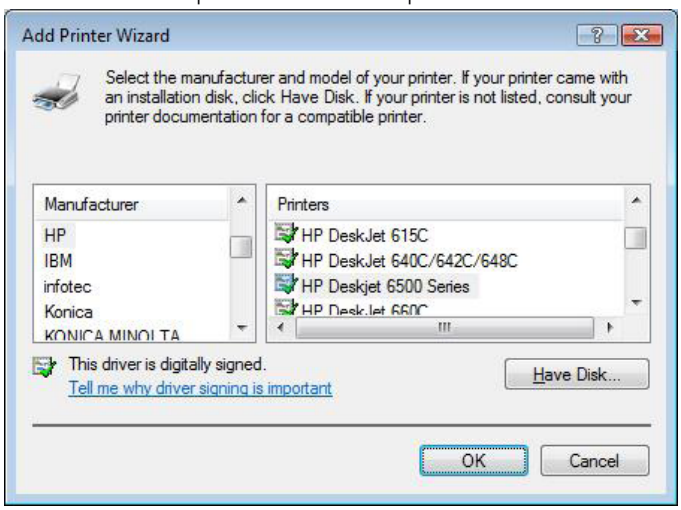
You can press The printer that I want isn't listed to go into next page without waiting for Searching for available printers to finish.

5. Click Select a shared printer by name.

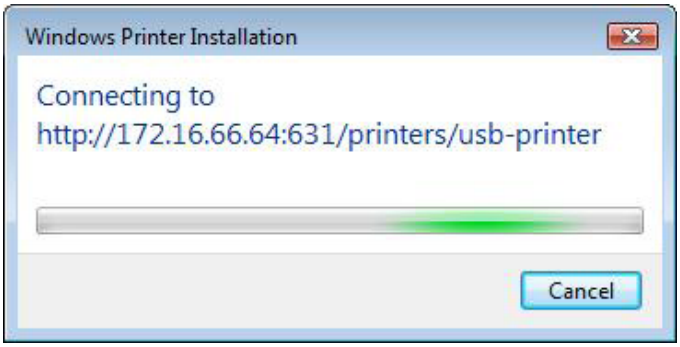


Type http://<Thecus_NAS>:631/printers/usb-printer in the box, where <Thecus_NAS_IP> is the IP address of Thecus IP storage. Click Next.

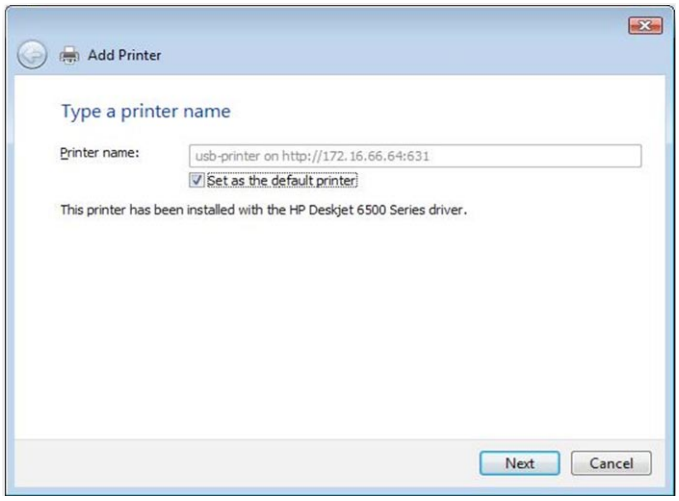
6. Select or install a printer and then press OK.


Add Printer Wizard
Select the manufacturer and model of your printer. If your printer came with an installation disk, click Have Disk. If your printer is not listed, consult your printer documentation for a compatible printer.
Manufacturer
HP
IBM
infotec
Konica
Printers
HP DeskJet 615C
HP DeskJet 640C/642C/648C
HP Deskjet 6500 Series
This driver is digitally signed.
Tell me why driver signing is important
Have Disk...
OK
Cancel

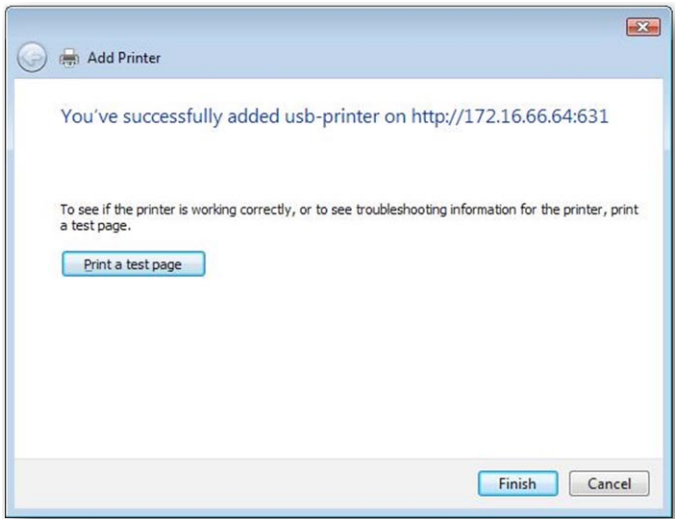
7. Windows will attempt to connect to the printer.



8. You can choose to set this printer as the default printer by checking the Set as the default printer box. Click Next to continue.

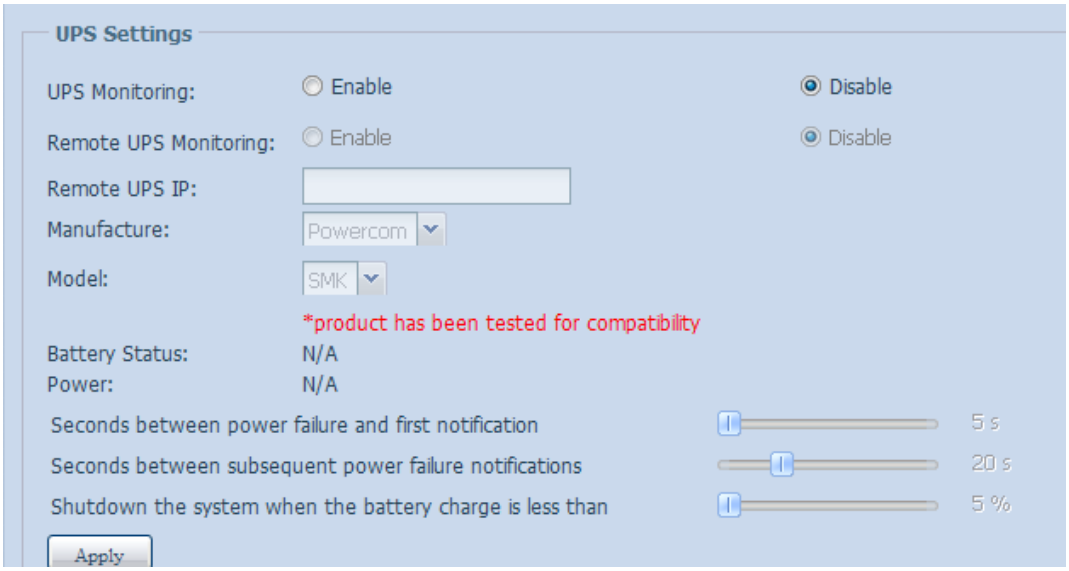


9. Done! Click Finish.


Add Printer
You've successfully added usb-printer on http://172.16.66.64:631
To see if the printer is working correctly, or to see troubleshooting information for the printer, print a test page.
Print a test page
Finish
Cancel

3.9.2 Uninterrupted Power Source

From the External Devices menu, choose the Uninterrupted Power Source item and the UPS Setting screen appears. Make any changes you wish, and press Apply to confirm changes.



See the following table for a detailed description of each item.

UPS Setting	
Item	**Description**
UPS Monitoring	Enable or disable UPS monitoring.
Remote UPS Monitoring	Enable or disable Remote UPS monitoring.
Remote UPS IP	Input the IP address of the NAS that the UPS device is connected to via USB or RS232.Input the IP address of your network UPS.
Manufacturer	Choose the UPS manufacturer from the dropdowns.
Model	Choose the UPS model number from the dropdowns.
Battery Status	Current status of the UPS battery
Power	Current status of the power being supplied to the UPS
Seconds between power failure and first notification	Delay between power failure and first notification in seconds.
Seconds between subsequent power failure notifications	Delay between subsequent notifications in seconds.
Shutdown the system when the battery charge is less than	Amount of UPS battery remaining before system should auto-shutdown.
Apply	Press ***Apply*** to save your changes.

❖ Appendix A: Customer Support

If your Thecus IP storage is not working properly, we encourage you to check out Chapter 6: Trouble-shooting, located in this manual. You can also try to ensure that you are using the latest firmware version for your Thecus IP storage. Thecus is committed to providing free firmware upgrades to our customers. Our newest firmware is available on our Download Center:

http://www.thecus.com/download.php

If you are still experiencing problems with your Thecus IP storage, or require a Return Merchandise Authorization (RMA), feel free to contact technical support via our Technical Support Website:

http://www.thecus.com/support_tech.php

Customers in the US should send all technical support enquiries to the US contact window included in the following web page:

http://www.thecus.com/support_tech.php

For Sales Information you can e-mail us at:

sales@thecus.com

Thank you for choosing Thecus!

❖ Appendix B: RAID Basics

• Overview

A Redundant Array of Independent Disks (RAID) is an array of several hard disks that provide data security and high performance. A RAID system accesses several hard disks simultaneously, which improves I/O performance over a single hard disk. Data security is enhanced by a RAID, since data loss due to a hard disk failure is minimized by regenerating redundant data from the other RAID hard disks.

• Benefits

RAID improves I/O performance, and increases data security through fault tolerance and redundant data storage.

• Improved Performance

RAID provides access to several hard disk drives simultaneously, which greatly increases I/O performance.

• Data Security

Hard disk drive failure unfortunately is a common occurrence. A RAID helps prevent against the loss of data due to hard disk failure. A RAID offers additional hard disk drives that can avert data loss from a hard disk drive failure. If a hard drive fails, the RAID volume can regenerate data from the data and parity stored on its other hard disk drives.

• RAID Levels

The Thecus IP storage supports standard RAID levels 0, 1, 5, 6, 10 and JBOD. You choose a RAID level when you create a system volume. The factors for selecting a RAID level are:

- Your requirements for performance
- Your need for data security
- Number of hard disk drives in the system, capacity of hard disk drives in the system

The following is a description of each RAID level:

RAID 0

RAID 0 is best suited for applications that need high bandwidth but do not require a high level of data security. The RAID 0 level provides the best performance of all the RAID levels, but it does not provide data redundancy.

RAID 0 uses disk striping and breaking up data into blocks to write across all hard drives in the volume. The system can then use multiple hard drives for faster read and write. The stripe size parameter that was set when the RAID was created determines the size of each block. No parity calculations complicate the write operation.

RAID 1

RAID 1 mirrors all data from one hard disk drive to a second one hard disk drive, thus providing complete data redundancy. However, the cost of data storage capacity is doubled.

This is excellent for complete data security.

RAID 5

RAID 5 offers data security and it is best suited for networks that perform many small I/O transactions at the same time, as well as applications that require data security such as office automation and online customer service. Use it also for applications with high read requests but low write requests.

RAID 5 includes disk striping at the byte level and parity information is written to several hard disk drives. If a hard disk fails the system uses parity stored on each of the other hard disks to recreate all missing information.

RAID 6

RAID 6 is essentially an extension of RAID level 5 which allows for additional fault tolerance by using a second independent distributed parity scheme (dual parity)

Data is striped on a block level across a set of drives, just like in RAID 5, and a second set of parity is calculated and written across all the drives; RAID 6 provides for an extremely high data fault tolerance and can sustain two simultaneous drive failures.

This is a perfect solution for mission critical applications.

RAID 10

RAID 10 is implemented as a striped array whose segments are RAID 1 arrays. RAID 10 has the same fault tolerance as RAID level 1.

RAID 10 has the same overhead for fault-tolerance as mirroring alone. High I/O rates are achieved by striping RAID 1 segments.

Under certain circumstances, RAID 10 array can sustain up to 2 simultaneous drive failures

Excellent solution for applications that would have otherwise gone with RAID 1 but need an additional performance boost.

JBOD

Although a concatenation of disks (also called JBOD, or "Just a Bunch of Disks") is not one of the numbered RAID levels, it is a popular method for combining multiple physical disk drives into a single virtual one. As the name implies, disks are merely concatenated together, end to beginning, so they appear to be a single large disk.

As the data on JBOD is not protected, one drive failure could result total data loss.

Stripe Size

The length of the data segments being written across multiple hard disks. Data is written in stripes across the multiple hard disks of a RAID. Since multiple disks are accessed at the same time, disk striping enhances performance. The stripes can vary in size.

Disk Usage

When all disks are of the same size, and used in RAID, Thecus IP storage disk usage percentage is

listed below:

RAID Level	Percentage Used
RAID 0	100%
RAID 1	1/n x 100%
RAID 5	(n-1)/n x 100%
RAID 6	(n-2)/n x 100%
RAID 10	50%
JBOD	100%

n: HDD number

❖ Appendix C: Licensing Information

- **Overview**

This product included copyrighted third-party software licensed under the terms of GNU General Public License. Please see THE GNU General Public License for extra terms and conditions of this license.

Source Code Availability

Thecus Technology Corp. has exposed the full source code of the GPL licensed software. For more information on how you can obtain our source code, please visit our web site, http://www.thecus.com.

- **Copyrights**

  - This product includes cryptographic software written by Eric Young (eay@cryptsoft.com).
  - This product includes software developed by Mark Murray.
  - This product includes software developed by Eric Young (eay@cryptsoft.com).
  - This product includes software developed by the OpenSSL Project for use in the OpenSSL Toolkit (http://www.openssl.org/).
  - This product includes PHP, freely available from (http://www.php.net/).
  - This product includes software developed by the University of California, Berkeley and its contributors.
  - This product includes software developed by Winning Strategies, Inc.
  - This product includes software developed by the Apache Group for use in the Apache HTTP server project (http://www.apache.org/).
  - This product includes software developed by Softweyr LLC, the University of California, Berkeley, and its contributors.
  - This product includes software developed by Bodo Moeller.
  - This product includes software developed by Greg Roelofs and contributors for the book, "PNG: The Definitive Guide," published by O'Reilly and Associates.
  - This product includes software developed by the NetBSD Foundation, Inc. and its contributors.
  - This product includes software developed by Yen Yen Lim and North Dakota State University.
  - This product includes software developed by the Computer Systems Engineering Group at Lawrence Berkeley Laboratory.
  - This product includes software developed by the Kungliga Tekniska Högskolan and its contributors.
  - This product includes software developed by the Nick Simicich.
  - This product includes software written by Tim Hudson (tjh@cryptsoft.com).
  - This product includes software developed by Christopher G. Demetriou for the NetBSD Project.

- **CGIC License Terms**

Basic License

CGIC, copyright 1996, 1997, 1998, 1999, 2000, 2001, 2002, 2003, 2004 by Thomas Boutell and Boutell. Com, Inc.

Permission is granted to use CGIC in any application, commercial or noncommercial, at no cost. HOWEVER, this copyright paragraph must appear on a "credits" page accessible in the public online and offline documentation of the program. Modified versions of the CGIC library should not be distributed without the attachment of a clear statement regarding the author of the modifications, and this notice may in no case be removed. Modifications may also be submitted to the author for inclusion in the main CGIC distribution.

GNU General Public License

Version 2, June 1991

Copyright © 1989, 1991 Free Software Foundation, Inc.

51 Franklin St, Fifth Floor, Boston, MA 02110-1301 USA

Everyone is permitted to copy and distribute verbatim copies of this license document, but changing it is not allowed.

- **PREAMBLE**

The licenses for most software are designed to take away your freedom to share and change it. By contrast, the GNU General Public License is intended to guarantee your freedom to share and change free software--to make sure the software is free for all its users. This General Public License applies to most of the Free Software

Foundation's software and to any other program whose authors commit to using it. (Some other Free Software Foundation software is covered by the GNU Library General Public License instead.) You can apply it to your programs, too.

When we speak of free software, we are referring to freedom, not price. Our General Public Licenses are designed to make sure that you have the freedom to distribute copies of free software (and charge for this service if you wish), that you receive source code or can get it if you want it, that you can change the software or use pieces of it in new free programs; and that you know you can do these things.

To protect your rights, we need to make restrictions that forbid anyone to deny you these rights or to ask you to surrender the rights. These restrictions translate to certain responsibilities for you if you distribute copies of the software, or if you modify it.

For example, if you distribute copies of such a program, whether gratis or for a fee, you must give

the recipients all the rights that you have. You must make sure that they, too, receive or can get the source code. And you must show them these terms so they know their rights.

We protect your rights with two steps: (1) copyright the software, and (2) offer you this license which gives you legal permission to copy, distribute and/or modify the software.

Also, for each author's protection and ours, we want to make certain that everyone understands that there is no warranty for this free software. If the software is modified by someone else and passed on, we want its recipients to know that what they have is not the original, so that any problems introduced by others will not reflect on the original authors' reputations.

Finally, any free program is threatened constantly by software patents. We wish to avoid the danger that redistributors of a free program will individually obtain patent licenses, in effect making the program proprietary. To prevent this, we have made it clear that any patent must be licensed for everyone's free use or not licensed at all.

The precise terms and conditions for copying, distribution and modification follow.

TERMS AND CONDITIONS FOR COPYING, DISTRIBUTION AND MODIFICATION

0. This License applies to any program or other work which contains a notice placed by the copyright holder saying it may be distributed under the terms of this General Public License. The "Program", below, refers to any such program or work, and a "work based on the Program" means either the Program or any derivative work under copyright law: that is to say, a work containing the Program or a portion of it, either verbatim or with modifications and/or translated into another Language. (Hereinafter, translation is included without limitation in the term "modification".) Each licensee is addressed as "you".

Activities other than copying, distribution and modification are not covered by this License; they are outside its scope. The act of running the Program is not restricted, and the output from the Program is covered only if its contents constitute a work based on the Program (independent of having been made by running the Program).

Whether that is true depends on what the Program does.

1. You may copy and distribute verbatim copies of the Program's source code as you receive it, in any medium, provided that you conspicuously and appropriately publish on each copy an appropriate copyright notice and disclaimer of warranty; keep intact all the notices that refer to this License and to the absence of any warranty; and give any other recipients of the Program a copy of this License along with the Program.

You may charge a fee for the physical act of transferring a copy, and you may at your option offer

warranty protection in exchange for a fee.

2. You may modify your copy or copies of the Program or any portion of it, thus forming a work based on the Program, and copy and distribute such modifications or work under the terms of Section 1 above, provided that you also meet all of these conditions:

a) You must cause the modified files to carry prominent notices stating that you changed the files and the date of any change.

b) You must cause any work that you distribute or publish, that in whole or in part contains or is derived from the Program or any part thereof, to be licensed as a whole at no charge to all third parties under the terms of this License.

c) If the modified program normally reads commands interactively when run, you must cause it, when started running for such interactive use in the most ordinary way, to print or display an announcement including an appropriate copyright notice and a notice that there is no warranty (or else, saying that you provide a warranty) and that users may redistribute the program under these conditions, and telling the user how to view a copy of this License. (Exception: if the Program itself is interactive but does not normally print such an announcement, your work based on the Program is not required to print an announcement.)

These requirements apply to the modified work as a whole. If identifiable sections of that work are not derived from the Program, and can be reasonably considered independent and separate works in themselves, then this License, and its terms, do not apply to those sections when you distribute them as separate works. But when you distribute the same sections as part of a whole which is a work based on the Program, the distribution of the whole must be on the terms of this License, whose permissions for other licensees extend to the entire whole, and thus to each and every part regardless of who wrote it.

Thus, it is not the intent of this section to claim rights or contest your rights to work written entirely by you; rather, the intent is to exercise the right to control the distribution of derivative or collective works based on the Program.

In addition, mere aggregation of another work not based on the Program with the Program (or with a work based on the Program) on a volume of a storage or distribution medium does not bring the other work under the scope of this License.

3. You may copy and distribute the Program (or a work based on it, under Section 2) in object code or executable form under the terms of Sections 1 and 2 above provided that you also do one of the following:

a) Accompany it with the complete corresponding machine-readable source code, which must be distributed under the terms of Sections 1 and 2 above on a medium customarily used for soft-

ware interchange; or,

b) Accompany it with a written offer, valid for at least three years, to give any third party, for a charge no more than your cost of physically performing source distribution, a complete machine-readable copy of the corresponding source code, to be distributed under the terms of Sections 1 and 2 above on a medium customarily used for software interchange; or,

c) Accompany it with the information you received as to the offer to distribute corresponding source code. (This alternative is allowed only for noncommercial distribution and only if you received the program in object code or executable form with such an offer, in accord with Subsection b above.)

The source code for a work means the preferred form of the work for making modifications to it. For an executable work, complete source code means all the source code for all modules it contains, plus any associated interface definition files, plus the scripts used to control compilation and installation of the executable. However, as a special exception, the source code distributed need not include anything that is normally distributed (in either source or binary form) with the major components (compiler, kernel, and so on) of the operating system on which the executable runs, unless that component itself accompanies the executable.

If distribution of executable or object code is made by offering access to copy from a designated place, then offering equivalent access to copy the source code from the same place counts as distribution of the source code, even though third parties are not compelled to copy the source along with the object code.

4. You may not copy, modify, sublicense, or distribute the Program except as expressly provided under this License. Any attempt otherwise to copy, modify, sublicense or distribute the Program is void, and will automatically terminate your rights under this License. However, parties who have received copies, or rights, from you under this License will not have their licenses terminated so long as such parties remain in full compliance.

5. You are not required to accept this License, since you have not signed it. However, nothing else grants you permission to modify or distribute the Program or its derivative works. These actions are prohibited by law if you do not accept this License. Therefore, by modifying or distributing the Program (or any work based on the Program), you indicate your acceptance of this License to do so, and all its terms and conditions for copying, distributing or modifying the Program or works based on it.

6. Each time you redistribute the Program (or any work based on the Program), the recipient automatically receives a license from the original licensor to copy, distribute or modify the Program subject to these terms and conditions. You may not impose any further restrictions on the recipients' exercise of the rights granted herein. You are not responsible for enforcing compliance by third parties to this License.

7. If, as a consequence of a court judgment or allegation of patent infringement or for any other reason (not limited to patent issues), conditions are imposed on you (whether by court order, agreement or otherwise) that contradict the conditions of this License, they do not excuse you from the conditions of this License. If you cannot distribute so as to satisfy simultaneously your obligations under this License and any other pertinent obligations, then as a consequence you may not distribute the Program at all. For example, if a patent license would not permit royalty-free redistribution of the Program by all those who receive copies directly or indirectly through you, then the only way you could satisfy both it and this License would be to refrain entirely from distribution of the Program.

If any portion of this section is held invalid or unenforceable under any particular circumstance, the balance of the section is intended to apply and the section as a whole is intended to apply in other circumstances.

It is not the purpose of this section to induce you to infringe any patents or other property right claims or to contest validity of any such claims; this section has the sole purpose of protecting the integrity of the free software distribution system, which is implemented by public license practices. Many people have made generous contributions to the wide range of software distributed through that system in reliance on consistent application of that system; it is up to the author/donor to decide if he or she is willing to distribute software through any other system and a licensee cannot impose that choice.

This section is intended to make thoroughly clear what is believed to be a consequence of the rest of this License.

8. If the distribution and/or use of the Program is restricted in certain countries either by patents or by copyrighted interfaces, the original copyright holder who places the Program under this License may add an explicit geographical distribution limitation excluding those countries, so that distribution is permitted only in or among countries not thus excluded. In such case, this License incorporates the limitation as if written in the body of this License.

9. The Free Software Foundation may publish revised and/or new versions of the General Public License from time to time. Such new versions will be similar in spirit to the present version, but may differ in detail to address new problems or concerns.

Each version is given a distinguishing version number. If the Program specifies a version number of this License which applies to it and "any later version", you have the option of following the terms and conditions either of that version or of any later version published by the Free Software Foundation. If the Program does not specify a version number of this License, you may choose any version ever published by the Free Software Foundation.

10. If you wish to incorporate parts of the Program into other free programs whose distribution conditions are different, write to the author to ask for permission. For software which is copyrighted by the Free Software Foundation, write to the Free Software Foundation; we sometimes make exceptions for this. Our decision will be guided by the two goals of preserving the free status of all de-

rivatives of our free software and of promoting the sharing and reuse of software generally.

NO WARRANTY

11. BECAUSE THE PROGRAM IS LICENSED FREE OF CHARGE, THERE IS NO WARRANTY FOR THE PROGRAM, TO THE EXTENT PERMITTED BY APPLICABLE LAW. EXCEPT WHEN OTHERWISE STATED IN WRITING THE COPYRIGHT HOLDERS AND/OR OTHER PARTIES PROVIDE THE PROGRAM "AS IS" WITHOUT WARRANTY OF ANY KIND, EITHER EXPRESSED OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. THE ENTIRE RISK AS TO THE QUALITY AND PERFORMANCE OF THE PROGRAM IS WITH YOU. SHOULD THE PROGRAM PROVE DEFECTIVE, YOU ASSUME THE COST OF ALL NECESSARY SERVICING, REPAIR OR CORRECTION.

12. IN NO EVENT UNLESS REQUIRED BY APPLICABLE LAW OR AGREED TO IN WRITING WILL ANY COPYRIGHT HOLDER, OR ANY OTHER PARTY WHO MAY MODIFY AND/OR REDISTRIBUTE THE PROGRAM AS PERMITTED ABOVE, BE LIABLE TO YOU FOR DAMAGES, INCLUDING ANY GENERAL, SPECIAL, INCIDENTAL OR CONSEQUENTIAL DAMAGES ARISING OUT OF THE USE OR INABILITY TO USE THE PROGRAM (INCLUDING BUT NOT LIMITED TO LOSS OF DATA OR DATA BEING RENDERED INACCURATE OR LOSSES SUSTAINED BY YOU OR THIRD PARTIES OR A FAILURE OF THE PROGRAM TO OPERATE WITH ANY OTHER PROGRAMS), EVEN IF SUCH HOLDER OR OTHER PARTY HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES.

END OF TERMS AND CONDITIONS